

10: D300

NAME: Dr. C. Norton
Send Results to: Dr. C. Norton

Sampling		Field Station Identification	Lab Sample Number	Matrix Code	No. of Containers	General Chemistry		Micro	Biology	Metals		Organic Chemistry						
Date	Time					Acidity	Conductivity			Hardness	Iron		Aluminum	Calcium	Magnesium	Copper	Lead	Mercury
7/17	11:00	EB68-1A	8538	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8539	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8540	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8541	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8542	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8543	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8544	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8545	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8546	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8547	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8548	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8549	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8550	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8551	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8552	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8553	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8554	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8555	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8556	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8557	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8558	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8559	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic
7/17	11:00	EB68-1A	8560	1	1	Acidity	Conductivity	Hardness	Iron	Aluminum	Calcium	Magnesium	Copper	Lead	Mercury	PCBs	PAH's	Organic

[illegible]

Particulate samples submitted for analysis October 1994 (4th Quarter) for Elliott Bay Recontamination Study.

Station ID	Sample #	Trap 1	Station ID	Sample #	Trap 2	Station ID	Sample #	Composite Traps 1 + 2
EB1-S (Surface)			EB1-S			EB1-SOC		
1A	428400 %S		2A	428402 %S			428404	TOC, Metals, Semiv., PCBs, GS
1B	428401 %S		2B	428403 %S		EB1-BOC		
EB1-B (Bottom)			2A	- -			- -	
1A	428405 %S		2B	- -				
1B	428506 %S							
1C	428407 TOC, Metals, Semiv., PCBs		EB2-			EB2-OC	428412	TOC, Metals, Semiv., PCBs, GS
			2A	428410 %S				
			2B	428411 %S				
EB3-			EB3-			EB3-OC		
1A	428413 %S		2A	428416 %S			- -	
1B	428414 %S		2B	428417 %S				
1C	428415 TOC, Metals, Semiv., PCBs, GS		2C	428418 TOC, Metals, Semiv., PCBs, GS				
EB4-			EB4-			EB4-OC	428423	TOC, Metals, Semiv., PCBs, GS
1A	428419 %S		2A	428421 %S		EB4-OCD	428424	TOC, Metals, Semiv., PCBs, GS
1B	428420 %S		2B	428422 %S				
EB5-			EB5-			EB5-OC	428429	TOC, Metals, Semiv., PCBs, GS
1A	428425 %S		2A	428427 %S				
1B	428426 %S		2B	428428 %S				
EB6-S (Surface)			EB6-S			EB6-SOC	428434	TOC, Metals, Semiv., PCBs, GS
1A	428430 %S		2A	428432 %S				
1B	428431 %S		2B	428433 %S				
EB6-B (Bottom)			EB6-B			EB6-BOC	428439	TOC, Metals, Semiv., PCBs, GS
1A	428435 %S		2A	428437 %S				
1B	428436 %S		2B	428438 %S				
EB7-			EB7-			EB7-OC	428443	TOC, Metals Semiv., PCBs, GS
1A	428440 %S		2A	-				
1B	428441 %S		2B	428442 %S				
EB8-			EB8-			EB8-OC*	428449	TOC, Metals, Semiv., PCBs, GS
1A	428444 %S(dup)-428445		2A	428447 %S				
1B	428446 %S		2B	428448 %S				
EB9-			EB9-			EB9-OC	428454	TOC, Metals, Semiv., PCBs, GS
1A	428450 %S		2A	428452 %S				
1B	428451 %S		2B	428453 %S				

--No sample

Metals (11)- Al, As, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ag, Zn

Reference Materials (Organics)-analyzed in duplicate HS-2(PCB), HS-6(PAH)

Reference Material (Metals)- analyzed in duplicate ERA 216

*= Extra sample submitted for matrix spike and spike duplicate (semiv and PCBs)

LABORATORY ANALYSES REQUIRED

Project Name: Elliot Bay Remediation
 IC: D3000
 Results for: Date: 1/10 Mail Stop: 710

Results needed by Dec 5th (45 days)

☐ For HW Designation
☐ For NPDES

☐ Sediment Contamination
☐ Sediment

Sampling	Field Station Identification	Lab Sample Number	Matrix Code	No. of Containers	General Chemistry	Micro	Biology	Metals	Organic Chemistry
					pH Conductivity Hardness Turbidity Chloride Sulfate Cyanide Total Solids Total Nonvolatile Solids Total Suspended Solids Total Dissolved Solids Total Solids DOC (3 day) BOD (5 day) Ammonia Nitrate Nitrite Total Phosphorus Orthophosphorus Nitrogen TP TKN	Fecal Coliforms E. Coli % Klebsiella	Carodaphnia Daphnia Daphnia acute Daphnia chronic Fathead minnow Microtox Salmonella Salmonella Haz Waste	ICP Metals TCLP Metals Cd Cr Cu Ni Pb Zn Mercury (Hg) Total Rec W-2/SC11	BNA w/ extensive TIC's BNA w/ extensive TIC's PAH's VOA w/ extensive TIC's VOA w/ extensive TIC's BTEX Organochlorine Pesticides/PCBs PCB's only Organophosphorous Pests Chlorophenox Herbs WTPH-4-CID WTPH-4 WTPH-4-1 Modified AED screen
Mo	DA	HR	MIN						
020	EA15-1A	4284024021							
	-1B	8402							
	-2A	8402							
	-2B	8402							
	-0C	8404							
	EA18-1A	8404							
	-1B	8404							
	-2C	8404							
	EA15-1A	8408							
	-1B	8408							
	-2A	8410							
	-2B	8411							

Chain of Custody Record

Relinquished By: Dale Norton Received By: Dale Norton

Yr Mo Da Hr Mn

94/10/20/15:00

Seal I.D.

Condition of Seals

Comments

Comments: W-2/SC11 = Al, As, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ag, Zn

RA for laboratory sample to be shipped to Atlantic Shrub for Reference Materials

Project Officer: D. Norton

Can number: 6707-6765

Amplifiers: Dale Norton

Wiley Wilson

Order: Dale Norton

10/20/94

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Page No.

LABORATORY ANALYSES REQUIRED

Project Name: Fliott Bay Remediation
 SIC: D3C00
 and Results for: DN Mail Stop: 7710

Results needed by 12/5/94

☐ Preliminary Investigation
☐ For HW Designation
☐ For NPDES Monitoring

Sampling		Field Station Identification	Lab Sample Number	Matrix Code	Source Code	No. of Containers	General Chemistry			Micro	Biology	Metals	Organic Chemistry				
Date	Time						Alkalinity	Conductivity	pH					Turbidity	Chloride	Sulfate	Cyanide
01/04/94	0800	FB44-00D	428424	40423	01	1	✓	✓	✓	✓	✓	✓	✓				
01/04/94	0800	FB44-00D	428425	40423	01	1	✓	✓	✓	✓	✓	✓	✓				
01/04/94	0800	FB44-00D	428426	40423	01	1	✓	✓	✓	✓	✓	✓	✓				
01/04/94	0800	FB44-00D	428427	40423	01	1	✓	✓	✓	✓	✓	✓	✓				
01/04/94	0800	FB44-00D	428428	40423	01	1	✓	✓	✓	✓	✓	✓	✓				
01/04/94	0800	FB44-00D	428429	40423	01	1	✓	✓	✓	✓	✓	✓	✓				
01/04/94	0800	FB44-00D	428430	40423	01	1	✓	✓	✓	✓	✓	✓	✓				
01/04/94	0800	FB44-00D	428431	40423	01	1	✓	✓	✓	✓	✓	✓	✓				
01/04/94	0800	FB44-00D	428432	40423	01	1	✓	✓	✓	✓	✓	✓	✓				
01/04/94	0800	FB44-00D	428433	40423	01	1	✓	✓	✓	✓	✓	✓	✓				
01/04/94	0800	FB44-00D	428434	40423	01	1	✓	✓	✓	✓	✓	✓	✓				
01/04/94	0800	FB44-00D	428435	40423	01	1	✓	✓	✓	✓	✓	✓	✓				

Chain of Custody Record

Retrieved By: Dale Martin Received By: Dale Martin

Seal I.D. 5410201500

Comments: Chain Copy 12/10/94
See List #1 for CCR and Labels (11)

CORE LOGS

Elliott Bay Recontamination Study Sediment Core Log

No life

Date = 6-24-94
 Time = ~~11:30 am~~ 12:00 pm
 Station C1 = C1
 Location = ~~1130~~
 Lat - Not available
 Long -
 Water Depth (total ft) = 8 meters (26')
 Equipment = 4 in barrel corer
 Sediment Penetration (cm) = ~~137 cm~~ 137 cm
 Sediment Recovery (cm) = 84 cm
 After extrusion = 88 cm

LORAN
 279 93.3
 423 01.6

Core Description

Interval (cm)

Description

Top

0-15

Black, silty, oily

No visible life

15-27

Black, silty

No visible life

27-32

black, silty w/oil

No visible life

32-43

Black, silty

43-52

shell fragments, black silty w oil band

52-bottom (88)

black, silty w grey silt interior

To Bottom

Sediment Core Sectioning Log

0-20 One 2cm section every 5cm
 20-50 One 2cm section every 10cm
 50-bottom One 2cm section to be based on core length (Max 10
 Sections)
 Bottom One 2cm section

Interval (cm)	Label	Sample No.	Analysis
✓ 0-3	C1 - 1	268500	Sample (%S, TOC, Grain Size, Metals(7), PCBs , Pb-210, Cs-137)
3-5	C1 - 2	—	Archive
✓ 5-7	C1 - 3	268501	Sample (%S, Pb-210, Cs-137)
7-10	C1 - 4	—	Archive
✓ 10-12	C1 - 5	268502	Sample (%S, Pb-210, Cs-137)
12-15	C1 - 6	—	Archive
✓ 15-17	C1 - 7	268503	Sample (%S, Pb-210, Cs-137)
17-20	C1 - 8	—	Archive
✓ 20-22	C1 - 9	268504	Sample (%S, Pb-210, Cs-137)
22-30	C1 - 10	—	Archive
✓ 30-32	C1 - 11	268505	Sample (%S, Pb-210, Cs-137)
32-40	C1 - 12	—	Archive
✓ 40-42	C1 - 13	268506	Sample (%S, Pb-210, Cs-137)
42-50	C1 - 14	—	Archive

Sample Log (Station=) continued

Note- No Cs-137 below ⁵²~~50~~ cm, intervals based on total core length

Interval (cm)	Label	Sample No.	Analysis
✓ 50-52	C1-15	268507	Sample (%S, Pb-210) Cs-137
52-60	C1-16	—	Archive
✓ 60-62	C1-17	268508	%S, Pb-210
62-70	C1-18	—	Archive
✓ 70-72	C1-19	268509	%S, Pb-210
72-80	C1-20	—	Archive
✓ 80-82	C1-21	268510	%S, Pb-210
✓ 82-88	C1-22	268511	%S, Pb-210

Chemistry Sections

Interval (cm)	Label	Sample No.	Analysis	Section
✓ 0-5	C1-A	268512	TOC, GS, PCBs, metals	1-2
✓ 5-10	C1-B	268513	PCBs, metals (7)	3
✓ 10-20	C1-C	268514	PCBs, metals (7)	5-8
✓ 20-50	C1-D	268515	PCBs, metals (7)	9-14
✓ 50-80	C1-E	268516	PCBs, metals (7)	15-20
✓ 80-88	C1-F	268517	PCBs, metals (7)	21-22

Elliott Bay Recontamination Study

Sediment Core Log

Collected but Discarded

2nd Core

Date	= 6-24-94	11:40 pm
Time	= 11:20 pm	11:40 pm
Station	= C2	C2
Location	= 13	14 (at end of gangway)
Lat -		47° 36.32' N
Long-		122° 20.46' W
Water Depth (total ft)	= 9 meters	10 meters (33')
Equipment	=	4 in barrel
Sediment Penetration (cm)	= 91 inches	86 inches → 218.44 cm
Sediment Recovery (cm)	= 42 inches	40 inches → 101.6 cm
Measurements after correction	=	98 cm

Core Description

Interval (cm)

Description

Top 0-18	Black, silty, some shell fragments, no visible sheen
18-36	Black, silty, shell fragments. Visible sheen some organic debris
36-54	Black silty, visible sheen, shell fragments
54-98	Black, silty, limited shell fragments, silty sand

LORAN → 279 94.1
423 01.7

Sediment Core Sectioning Log

0-20	One 2cm section every 5cm
20-50	One 2cm section every 10cm
50-bottom	One 2cm section to be based on core length (Max 10 Sections)
Bottom	One 2cm section

Interval (cm)	Label	Sample No.	Analysis
✓ 0-3	C2-1	268518	Sample (%S, TOC, Grain Size, Metals(7), PCBs, Pb-210, Cs-137)
3-5	C2-2	—	Archive
✓ 5-7	C2-3	268519	Sample (%S, Pb-210, Cs-137)
7-10	C2-4	—	Archive
✓ 10-12	C2-5	268520	Sample (%S, Pb-210, Cs-137)
12-15	C2-6	—	Archive
✓ 15-17	C2-7	268521	Sample (%S, Pb-210, Cs-137)
17-20	C2-8	—	Archive
✓ 20-22	C2-9	268522	Sample (%S, Pb-210, Cs-137)
22-30	C2-10	—	Archive
✓ 30-32	C2-11	268523	Sample (%S, Pb-210, Cs-137)
32-40	C2-12	—	Archive
✓ 40-42	C2-13	268524	Sample (%S, Pb-210, Cs-137)
42-50	C2-14	—	Archive

Sample Log (Station =) continued

Note- No Cs-137 below ⁵²~~50~~ cm, intervals based on total core length

Interval (cm)	Label	Sample No.	Analysis
✓ 50-52	C2-15	268525	Sample (%S, Pb-210) Cs-137
52-60	C2-16	—	Archive
✓ 60-62	C2-17	268526	%S Pb-210
62-70	C2-18	—	Archive
✓ 70-72	C2-19	268527	%S, Pb-210
72-80	C2-20	—	Archive
✓ 80-82	C2-21	268528	%S, Pb-210
82-90	C2-22	—	Archive
✓ 90-92	C2-23	268529	%S, Pb-210
92-95	C2-24	—	Archive
✓ 95-98	C2-25	268530	%S, Pb-210

Chemistry Sections				Section
✓ 0-5	C2-A	268531	TOC, GS, PCB, Metals (7)	1-
✓ 5-10	C2-B	268532	PCB, Metals (7)	3-
✓ 10-20	C2-C	268533	PCB, Metals (7)	5-
✓ 20-50	C2-D	268534	PCB, Metals (7)	9-
✓ 50-80	C2-E	268535	PCB, Metals (7)	15-
✓ 80-98	C2-F	268536	PCB, Metals (7)	21-

Elliott Bay Recontamination Study Sediment Core Log

LORAN: 279 91.1
423 01.7

Date = 6-24-94
 Time = 2:50 pm
 Station = C3
 Location = 15
 GPS Lat - 47°36.05'
 Long- 122° 20.32' (NAD 1983)
 Water Depth (total ft) = 13 meters (43')
 Equipment = 4" barrel
 Sediment Penetration (cm) = 79 in = 200.7 cm
 Sediment Recovery (cm) = 61 in = 155 cm
 After Extrusion = 153 cm
 Core Description (silty clay thru out)

Interval (cm)	Description
Top 0-5	organic shell fragments, silty sand, grey
5-10	grey silty sand, organic debris, some shell fragments
10-18	shell fragments, org debris red worms present
18-38	Grey silt, shell fragments
38-46	silty
46-50	shell fragments
50-93	silty, grey
93-97	shell fragments

Core Description (Station =)- continued

Interval (cm)

Description

97-153 (bottom) grey, silt uniform, more silty sand

Sediment Core Sectioning Log

0-20	One 2cm section every 5cm
20-50	One 2cm section every 10cm
50-bottom	One 2cm section to be based on core length (Max 10 Sections)
Bottom	One 2cm section

Interval (cm)	Label	Sample No.	Analysis
✓ 0-3	C3 - 1	268537	Sample (%S, TOC, Grain-Size, Metals(7), PCBs, Pb-210, Cs-137)
3-5	C3 - 2	—	Archive
✓ 5-7	C3 - 3	268538	Sample (%S, Pb-210, Cs-137)
7-10	C3 - 4	—	Archive
✓ 10-12	C3 - 5	268539	Sample (%S, Pb-210, Cs-137)
12-15	C3 - 6	—	Archive
✓ 15-17	C3 - 7	268540	Sample (%S, Pb-210, Cs-137)
17-20	C3 - 8	—	Archive
✓ 20-22	C3 - 9	268541	Sample (%S, Pb-210, Cs-137)
22-30	C3 - 10	—	Archive
✓ 30-32	C3 - 11	268542	Sample (%S, Pb-210, Cs-137)
32-40	C3 - 12	—	Archive
✓ 40-42	C3 - 13	268543	Sample (%S, Pb-210, Cs-137)
42-50	C3 - 14	—	Archive

Sample Log (Station =) continued

Note- No Cs-137 below ⁵²50cm, intervals based on total core length

Interval (cm)	Label	Sample No.	Analysis
50-52	C3-15	268544	Sample (%S, Pb-210) ^{CS-137}
52-70	C3-16	—	Archive
70-72	C3-17	268545	%S, Pb-210
72-90	C3-18	—	Archive
90-92	C3-19	268546	%S, Pb-210
92-110	C3-20	—	Archive
110-112	C3-21	268547	%S, Pb-210
112-130	C3-22	—	Archive
130-132	C3-23	268548	%S, Pb-210
132-150	C3-24	—	Archive
150-153	C3-25	268549	%S, Pb-210

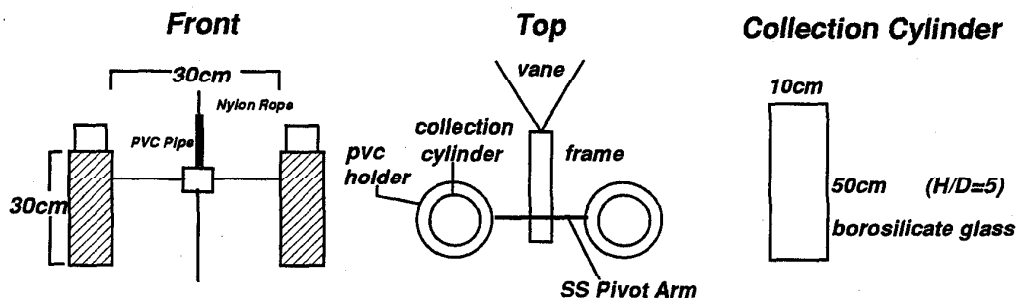
Chemistry Sections

0-5	C3-A	268550	TOC, GS, PCB, Metals (?)	1-2
5-10	C3-B	268551	PCB, Metals (?)	3-4
10-20	C3-C	268552	PCB, Metals (?)	5-8
20-50	C3-D	268553	PCB, Metals (?)	9-14
50-90	C3-E	268554	PCB, Metals (?)	15-18
90-110	C3-F	268555	PCB, Metals (?)	19-20
110-132	C3-G	268556	PCB, Metals (?)	21-23
132-153	C3-H	268557	PCB, Metals (?)	24-25

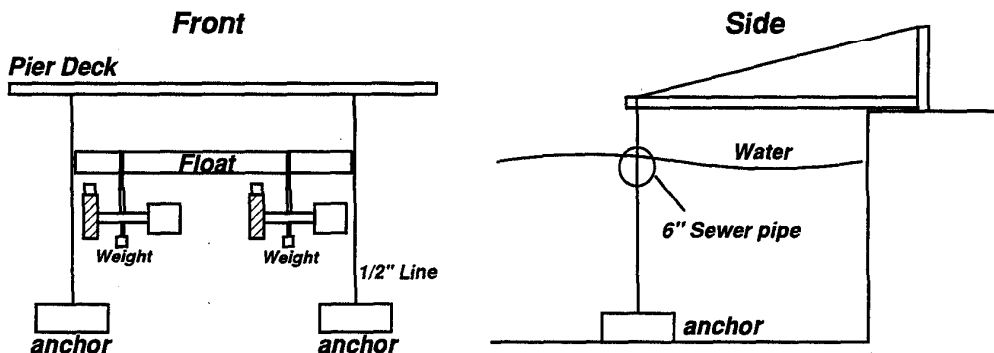
Duplicates

0-5	C3-AD	268558	TOC, GS
10-20	C3-CD	268559	PCB, Metals (?)
20-22	C3-9D	268560	Cs-137
10-12	C3-5D	268561	%S, Pb-210

I. Detailed View of Sediment Trap



II. Sediment Trap Deployment (Surface)



III. Sediment Trap Deployment (Bottom)

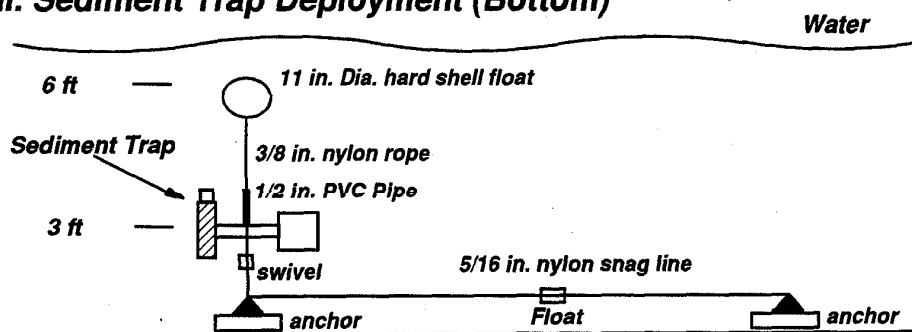


Figure B1: Schematic of Elliott Bay Sediment Traps and Moorings.

Appendix C - Quality Assurance Information

Summary of Quality Assurance Samples Analyzed (Table C1)

Quality Assurance Case Narratives

Chemistry

Current Meters (Aanderra Reports)

Summary of Reference Materials

Metals (Table C2)

Organics (Table C3)

Summary of Blind Field Duplicates (Table C4)

Table C1: Summary of quality assurance samples and frequency of analysis for the Elliott Bay Waterfront Recontamination Study.

Analyte	Internal Standards	Surrogate Spikes	Method Blank	Matrix Spike*	Reference Materials*	Field Duplicate*	Field Replicate
Percent Solids	-	-	-	-	-	2 Batch	1 Batch
Grain Size	-	-	-	-	-	2 Batch	1 Batch
Total Organic Carbon	-	-	1 Batch	2 Batch	-	2 Batch	1 Batch
Metals							
Aluminum	-	-	1 Batch	-	2 Batch	2 Batch	1 Batch
Arsenic	-	-	1 Batch	-	2 Batch	2 Batch	1 Batch
Cadmium	-	-	1 Batch	-	2 Batch	2 Batch	1 Batch
Chromium	-	-	1 Batch	-	2 Batch	2 Batch	1 Batch
Copper	-	-	1 Batch	-	2 Batch	2 Batch	1 Batch
Iron	-	-	1 Batch	-	2 Batch	2 Batch	1 Batch
Lead	-	-	1 Batch	-	2 Batch	2 Batch	1 Batch
Manganese	-	-	1 Batch	-	2 Batch	2 Batch	1 Batch
Mercury	-	-	1 Batch	-	2 Batch	2 Batch	1 Batch
Silver	-	-	1 Batch	-	2 Batch	2 Batch	1 Batch
Zinc	-	-	1 Batch	-	2 Batch	2 Batch	1 Batch
Organics							
Semivolatiles	1 sample	1 sample	1 Batch	2 Batch	(2 Batch)	2 Batch	1 Batch
PCBs	1 sample	1 sample	1 Batch	2 Batch	2 Batch	2 Batch	1 Batch
Pb-210	-	-	-	-	-	2 Batch	2 Batch
Cs-137	-	-	-	-	-	2 Batch	2 Batch

*= Samples are duplicates

()= PAH only

Certified Reference Materials

Metals- NIST #1646 (Estuarine Sediment)

PAH- NRCC #HS-6 (Harbour Marine)

PCBs- NRCC #HS-2 (Harbour Marine)

CASE NARRATIVES

GRAIN SIZE MAPPING

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

Data Review
September 27, 1993

Project: **Elliot Bay Recon Study**

Samples: 368500 through 368570

Laboratory: Soil Technology J-418

By: Karin Feddersen KF

Case Summary

The review is for sediment grain size using Puget Sound Estuary Program (P.S.E.P.) protocol.

These samples were received at the Manchester Environmental Laboratory on September 8, 1993. They were transported to Soil Technology on September 8, 1993 for analysis.

These analyses were reviewed for qualitative and quantitative accuracy, validity, and usefulness. The results are acceptable for use as reported.

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SOIL TECHNOLOGY

SPECIALIZING IN PHYSICAL SOIL TESTING

7865 N.E. Day Road West
Bainbridge Island, WA 98110
(206) 842-8977 Fax 842-9014

LETTER OF TRANSMITTAL

TO: Wa. State Dept. of Ecology
Manchester Laboratory
7411 Beach Drive East
Port Orchard, WA 98366-8204

DATE: 09-24-93
JOB NO: J-418

ATTENTION: Stuart Magoon

SUBJECT: Elliott Bay Recon Study

REFERENCE: Sample ID No. 36-8500 through 36-8570

We are sending the following items:

Date	Copies	Description
09-24-93	2	Apparent Sediment Grain Size Distribution (Page 1 through Page 18)
09-24-93	2	True Sediment Grain Size Distribution (Page 19 and 20)
09-24-93	2	Sediment Sample Case Narrative
09-24-93	2	Chain of Custody Records
09-24-93	2	Disk

These are transmitted for your use.

Remarks: Samples were tested in general accordance with Puget Sound Estuary Protocol (Conventional Sediment Variables Particle Size March 1986). Values reported are "apparent" particle size as organic material is included in the analysis and "true" particle size as organic material is excluded in the in the analysis. Because true and apparent distributions may differ, detailed comparisons between samples analyzed by these different methods are questionable. Please call if you have any questions regarding this submittal or presentation of the data.

Best Regards,
SOIL TECHNOLOGY, INC.



Richard G. Sheets,

Sediment Sample Case Narrative

Hydrogen Peroxide Digestion

Samples 36-8508, 36-8518, 36-8534, 36-8548, 36-8558

The "Weight of Solids" calculation does not account for organics lost in H₂O₂ digestion.

Therefore, the amount of solids calculated using the water content and the amount of solids retained after digestion may vary. Resulting QaQc values may exceed 5%.

Sample 36-8551

The following is a description of quality control procedures used in weight of solids determination for sample 36-8551. Following analysis, a comparison of the weight of solids calculated by the standard method and the weight of solids calculated using a formula devised by Folk* revealed a discrepancy. The weight of solids is generally calculated using the standard formula:

$$\text{weight of solids} = \frac{\text{wet wt. of sample}}{1 + \text{water content}}$$

The Folk method alternatively determines the weight of solids by adding together the coarse fraction > U.S. Sieve #230 and the fine fraction < U.S. Sieve # 230:

$$\text{Wt solids} = >\#230 \text{ material} + 50(20 \text{ second pipet reading})$$

For a given sample, the resulting values from these equations should agree. When a discrepancy occurs, the standard procedure is to resample for a second water content. The sample mentioned above did not contain enough representative material for resampling. The Folk method was used to determine the weight of solids on the above sample.

*(R. L. Folk, Petrology of Sedimentary Rocks 1974, pp. 38-39)

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State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

Data Review
October 13, 1993

Project: **Elliot Bay Recon Study**

Samples: 398571 through 398577

Laboratory: Soil Technology J-418

By: Karin Feddersen KF

Case Summary

The review is for sediment grain size using Puget Sound Estuary Program (P.S.E.P.) protocol.

These samples were received at the Manchester Environmental Laboratory on September 24, 1993. They were transported to Soil Technology on September 27, 1993 for Grain Size analysis. Samples 398571 through 398576 were analyzed according to apparent sediment grain size distribution. Sample 398577 was analyzed according to true sediment grain size distribution.

These analyses were reviewed for qualitative and quantitative accuracy, validity, and usefulness. The results are acceptable for use as reported.

SOIL TECHNOLOGY

SPECIALIZING IN PHYSICAL SOIL TESTING

7865 N.E. Day Road West
Bainbridge Island, WA 98110
(206) 842-8977 Fax 842-9014

LETTER OF TRANSMITTAL

TO:**Wa. State Dept. of Ecology
Manchester Laboratory
7411 Beach Drive East
Port Orchard, WA 98366-8204****DATE: 10-07-93
JOB NO: J-418****ATTENTION:****Karin Feddersen****SUBJECT:****Elliott Bay Recon Study****REFERENCE:****Sample ID No. 39-8571 through 39-8577**

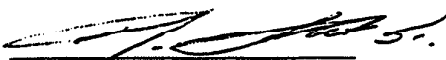
We are sending the following items:

Date	Copies	Description
10-07-93	2	Apparent Sediment Grain Size Distribution (Page 1 and 2)
10-07-93	2	True Sediment Grain Size Distribution (Page 3)
10-07-93	2	Standard Operating Procedure for Salt Correction (Page 4)
10-07-93	1	Chain of Custody Records
10-07-93	1	Disk

These are transmitted for your use.

Remarks: Samples were tested in general accordance with Puget Sound Estuary Protocol (Conventional Sediment Variables Particle Size March 1986). Values reported are "apparent" particle size as organic material is included in the analysis and "true" particle size as organic material is excluded in the in the analysis. Because true and apparent distributions may differ, detailed comparisons between samples analyzed by these different methods are questionable. Please call if you have any questions regarding this submittal or presentation of the data.

Best Regards,
SOIL TECHNOLOGY, INC.


Richard G. Sheets,
Vice President

**FIRST QUARTER
PARTICULATE
MONITORING
DATA**

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State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

Data Review
February 24, 1994

Project: **Elliot Bay Recontamination Study**

Samples: 038274

Laboratory: Soil Technology J-501

By: Karin Feddersen KF

Case Summary

The review is for sediment grain size using Puget Sound Estuary Program (P.S.E.P.) protocol.

This sample was received at the Manchester Environmental Laboratory on December 16, 1993, and transported to Soil Technology on December 16, 1993 for Grain Size analysis by Pipette only.

These analyses were reviewed for qualitative and quantitative accuracy, validity, and usefulness. The results are acceptable for use as reported.

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LETTER OF TRANSMITTAL

SOIL TECHNOLOGY

SPECIALIZING IN PHYSICAL SOIL TESTING

7865 N.E. Day Road West
Bainbridge Island, WA 98110
(206) 842-8977 Fax 842-9014

TO:

Wa. State Dept. Of Ecology
7411 Beach Drive East
Port Orchard, WA 98366-8204

DATE: 02-16-94

JOB NO: J-501

ATTENTION:

Karin Feddersen

SUBJECT:

Elliott Bay Recontamination Study

RE:

Sample ID No. 038274

We are sending the following items:

Date	Copies	Description
02-16-94	2	Grain Size Determination/Dissolved Solids Correction (Page 1)
02-16-94	1	Summary of Entry Values (1 page)
02-16-94	1	Chain of Custody Record
02-16-94	1	Original Invoice No. 696

These are transmitted for your use.

Remarks: Values reported are "apparent" particle size as organic material is included in the analysis. Samples were tested in general accordance with Puget Sound Estuary Protocol (Conventional Sediment Variables Particle Size, March 1986) and EPA, US Army Corps of Engineers "Dredge Material Testing Manual, February 1991". According to this method, the determination of parameters in sediment and water from estuarine or marine environments have to explicitly address steps taken to control salt interference. Steps were taken to correct for salt interference and these corrections are referred to as dissolved solids. Please call if you have any questions regarding this submittal or presentation of the data. Thank you.

Best Regards,
SOIL TECHNOLOGY, INC.



Richard G. Sheets,
Vice President

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State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

February 24, 1994

Project: **Elliot Bay**

Samples: 038236, 038246, 038255, 038258, 038270 through 038276, 038278, 038279, 038279

Laboratory: Weyerhaeuser Analytical and Testing Services 13874

By: Karin Feddersen *KF*

These samples were received at the Manchester Laboratory on January 24, 1994, and were sent to Weyerhaeuser Analytical and Testing Services on January 24, 1994 for TOC analysis using PSEP.

HOLDING TIMES

The holding time for frozen sediments is six (6) months. There have been no studies performed to indicate the effect of holding time on samples that have not been stored frozen prior to analysis. Therefore an evaluation of the results with regard to holding time is not feasible. All samples were stored in the proper containers at 4 degrees C until analysis. All analyses were performed within seventeen (17) days of collection.

PROCEDURAL BLANKS

The procedural blanks associated with these samples demonstrated that the processes were free from contamination.

INITIAL CALIBRATION

The % Relative Standard Deviation (%RSD) was within QC limits of $\leq 20\%$.

CHECK STANDARDS

All Check Standard recoveries are reasonable, acceptable, and within QC limits of 90% to 100%.

DUPLICATES

The Relative Percent Difference (RPD) of the duplicate analyses to the original analyses are within QC limits of $\leq 10\%$.

SUMMARY

This data is acceptable for use as amended.

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MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive E, Port Orchard Washington 98366

CASE NARRATIVE

March 24, 1994

Subject: Elliott Bay Recontamination

Samples: 94 - 038228, -038229, --038236, -038258, -038270, -038272 to -038279

Case No. DOE-966Y

Officer: Dale Norton

By: Dickey D. Huntamer *[Signature]*
Organics Analysis Unit

SEMIVOLATILE ORGANICS

ANALYTICAL METHODS:

The semivolatile soil samples were Soxhlet extracted with acetone following the Manchester modification of the EPA SW 846 8270 procedure with capillary GC/MS analysis of the sample extracts. The sample extracts were cleaned up prior to analysis using silica gel. By eluting with various mixtures of solvents the semivolatile target compounds could be recovered. Normal QA/QC procedures were performed with the analyses. A pair of Canadian reference materials (HS-6) sample numbers 94-038228 and -038229, were also analyzed with the samples.

HOLDING TIMES:

The samples were stored frozen until sample preparation following Puget Sound Estuary Program guidelines. All sample and extraction holding times were within the recommended limits.

BLANKS:

Low levels of some target compounds were detected in the laboratory blanks. The EPA five times rule was applied to all target compounds which were found in the blank. Compounds that were found in the sample and in the blank were considered real and not the result of contamination if the levels in the sample are greater than or equal to five times the amount of compounds in the associated method blank.

SURROGATES:

The normal surrogate compounds were added to the sample prior to extraction. Surrogate spike recoveries were within acceptable QC limits except for one of the laboratory blanks, 94-038272 LBK2 (BS4033), where all of the surrogate recoveries were low. The "J" data qualifier was added to the results for this blank. The other blank was okay and no additional qualifiers were added to the data because of surrogate recoveries.

MATRIX SPIKE AND MATRIX SPIKE DUPLICATE:

Matrix spike recoveries were within acceptable limits for most of the compounds. A number of compounds, particularly the Polynuclear Aromatic Hydrocarbons (PAH) were found at high levels in the matrix source sample. Corrections to the matrix spikes for the native concentrations could not be made in all cases, resulting in high recoveries for some compounds. No qualifiers were added due to high recoveries. A "J" qualifier was added to results of matrix source sample, -038273, for those compounds where the recoveries were low.

SPECIAL ANALYTICAL PROBLEMS:

No special analytical problems were encountered in the semivolatile analyses other than the high PAH concentrations present in many of the samples. Almost every sample required a dilution to bring the highest concentrations within the calibration curve. The data is acceptable for use as qualified.


DATA QUALIFIER CODES:

- U - The analyte was not detected at or above the reported value.
- J - The analyte was positively identified. The associated numerical value is an estimate.
- UJ - The analyte was not detected at or above the reported estimated result.
- REJ - The data are unusable for all purposes.
- EXP - The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals 3×10^6 .
- NAF - Not analyzed for.
- N - For organic analytes there is evidence the analyte is present in this sample.
- NJ - There is evidence that the analyte is present. The associated numerical result is an estimate.
- E - This qualifier is used when the concentration of the associated value exceeds the known calibration range.
- * - The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.)

MANCHESTER ENVIRONMENTAL LABORATORY
7411 Beach Drive E , Port Orchard Washington 98366

CASE NARRATIVE

March 9, 1994

Subject: Elliott Bay Recontamination
Samples: 94 - 038226, -038227, -038236, -038258, -038270, -038272 to -038279
Case No. DOE-966Y
Officer: Dale Norton
By: Dickey D. Huntamer 
Organics Analysis Unit

POLYCHLORINATED BIPHENYLS

ANALYTICAL METHODS:

The soil samples were Soxhlet extracted using acetone as the solvent. Analysis was done by EPA Method 8080 using dual column capillary GC analysis with Electron Capture Detectors (ECD).

HOLDING TIMES:

The samples were extracted within 14 days of collection and were analyzed within forty days of extraction.

BLANKS:

No target compounds were detected in the laboratory blanks.

SURROGATES:

Four surrogate compounds were analyzed with the PCB's. Dibutylchlorendate was removed during the Florisil cleanup step in most sample. Surrogates ranged from 48% to 104% recovery. Surrogate spike recoveries were within the acceptable QC limits of 50% to 150% for most of the samples. Only sample - 038278 had recoveries less than 50% (48% and 49% for 4,4'-Dibromo-octafluorobiphenyl and Tetrachlorometaxylene respectively). The surrogate most representative of PCB's, Decachlorobiphenyl had 58% recovery. No data was qualified because of surrogate recoveries.

MATRIX SPIKE AND MATRIX SPIKE :

The matrix spikes recoveries ranged from 95% to 108%. The Relative Percent Differences (RPD) ranged from 6.7% to 7.1%. All recoveries and RPD were within acceptable QC limits.

SPECIAL ANALYTICAL PROBLEMS:

There were no significant problems with the Pesticide/PCB analysis except that sample -38272 was lost when the Soxhlet extracted cracked and the solvent was lost. Since all of the sample was used in the first extraction the sample could not be re-extracted. Two reference samples were analyzed with the sample set. These are identified as 94-038226 and -038227. Canadian reference material HS-2 was used in the analysis. Both PCB-1254 and PCB-1260 were detected in the reference samples. The RPD was 1.0% for PCB-1254 and 4.3% for PCB-1260.

DATA QUALIFIER CODES:

- | | | |
|-----|---|--|
| U | - | The analyte was not detected at or above the reported value. |
| J | - | The analyte was positively identified. The associated numerical value is an <u>estimate</u> . |
| UJ | - | The analyte was not detected at or above the reported estimated result. |
| REJ | - | The data are <u>unusable</u> for all purposes. |
| EXP | - | The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals 3×10^6 . |
| NAF | - | Not analyzed for. |
| N | - | For organic analytes there is evidence the analyte is present in this sample. |
| NJ | - | There is evidence that the analyte is present. The associated numerical result is an estimate. |
| E | - | This qualifier is used when the concentration of the associated value exceeds the known calibration range. |
| * | - | The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.) |



STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive East • Port Orchard, Washington 98366-8204 • (206) 871-8860 • SCAN 871-8860

March 9, 1994

TO: Dale Norton

FROM: Bill Kammin, Environmental_Lab_Director *BK*

SUBJECT: Metals Quality Assurance memo for the Elliott Bay Recontamination Project

SAMPLE INFORMATION

These samples from the Elliott Bay Recontamination project were received by the Manchester Laboratory on 1/24/94 in good condition.

HOLDING TIMES

All analyses were performed within the USEPA Contract Laboratory Program (CLP) holding times for metals analysis (28 days for mercury, 180 days for all other metals).

INSTRUMENT CALIBRATION

Instrument calibration was performed before each analytical run and checked by initial calibration verification standards and blanks. Continuing calibration standards and blanks were analyzed at a frequency of 10% during the run and again at the end of the analytical run. All initial and continuing calibration verification standards were within the relevant USEPA (CLP) control limits. AA calibration gave a correlation coefficient (r) of 0.995 or greater, also meeting CLP calibration requirements.

PROCEDURAL BLANKS

The procedural blanks associated with these samples showed no analytically significant levels of analytes.

SPIKED SAMPLE ANALYSES

Spike and duplicate spike sample analyses were performed on this data set. All spike recoveries were within the CLP acceptance limits of +/- 25%, with the following exceptions: mercury. One mercury spike was low at 63%. Mercury data is qualified with N. Additionally, due to high sulfide content, one of the duplicate spikes was lost.

A small recycling symbol located at the bottom right of the page.

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during the ICP spike microwave digestion (possibly squid related). Precision data is not available for ICP results.

LABORATORY CONTROL SAMPLE (LCS) ANALYSES

NIST 1646 and ERA solid material 216 were analysed three times for this project. Cadmium and silver results are qualified with J, denoting estimated values based on LCS recoveries. NIST 2704, Buffalo River sediment, was digested once and analyzed three times with acceptable recoveries for mercury analyses.

SUMMARY

Data generation for this data set was complicated by high sulfide levels found in some of the samples, possibly related to large marine organisms finding their way into the sediment traps.

A tabular compilation of LCS recoveries is provided as an attachment.

The data generated by the analysis of these samples can be used noting the data qualifications discussed in this memo.

Please call Bill Kammin at SCAN 206-871-8801 to further discuss this project.

WRK:wrk

attachment

**Battelle**

Pacific Northwest Division

Marine Sciences Laboratory
1329 West Sequim Bay Road
Sequim, Washington 98382-9099
Telephone (206) 683-4151
Facsimile (206) 681-3699

May 9, 1994

Mr. Stuart Magoon
Washington State Department
of Ecology
Manchester Laboratory
7411 Beach Drive East
Port Orchard, WA 98366-8204

Dear Stuart:

Enclosed are the results for Pb-210 in sediment samples received in January 1994. The data is late because we had to reanalyze due to initially spiking samples with the wrong internal standard.

The blanks are low (1 to 4 counts/day). The blank spike recovery of Po208 (the internal standard) is consistent with these samples and previous batches of samples. The check samples are consistent with previous analyses. The precision for the duplicate is 12% RPD.

The calculations used to reduce the data consist of:

1. Blank subtraction.
2. Correction of decay of the Po208 internal standard certified at 1435 dpm/mL on June 11, 1986. Samples were spiked with 0.025 mL which is about 5.52 dpm/sample.
3. The counting efficiency is the ratio of Po208 spike 5.52 dpm/Po208 counted. For Check R-1, Po208 counted is 219c/day or 0.1521 cpm.

$$5.52 \text{ dpm} / 0.1521 \text{ cpm} = 36.26 \text{ d/c}$$

4. The Po210 counts are multiplied by the d/c such as 553 c/day or $0.384 \text{ cpm} \times 36.26 = 13.93 \text{ dpm}$.
5. The activity of check R-1 13.93 is divided by sample digestion dry weight then corrected for decay of Po210 since digestion and decay of Po210 since log-in time.

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Mr. Stuart Magoon
May 9, 1994
Page 2

If you have any questions about the calculations, call Rob Cuello or me.

Enclosed are the raw data, digestion logs, and an invoice for the amount of \$1,350.

Sincerely,

Bench Larson for EAC
Eric Crecelius
Technical Group Manager
Marine and Environmental Chemistry

:at

Enclosures

**SECOND QUARTER
PARTICULATE
MONITORING
DATA**

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2nd Quarter Traps

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

Data Review
May 10, 1994

Project: **Elliot Bay Study**

Samples: 168404,09,14,15,19,23,28,36,39,45,50

Laboratory: Soil Technology

By: Pam Covey *pc*

Case Summary

The review is for sediment grain size using Puget Sound Estuary Program (P.S.E.P.) protocol.

These samples were received at the Manchester Environmental Laboratory on April 21, 1994. They were transported to Soil Technology on April 25, 1994 for Grain Size analysis. These analyses were reviewed for qualitative and quantitative accuracy, validity, and usefulness.

The results are acceptable for use as reported.

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

May 16, 1994

Project: **Elliot Bay Recontamination Study**

Samples: 168404, 168409, 168414, 168415, 168419, 168423, 168428, 168431,
168436, 168439, 168445, 168450

Laboratory: Analytical Resources Inc. H037

By: Karin Feddersen KF

These samples were received at Manchester Laboratory on April 21, 1994, and were transported to Analytical Resources, Inc. on April 25, 1994 for TOC analysis using the following method: Puget Sound Ambient Monitoring Program.

DATA QUALIFIER DEFINITIONS

- U - The analyte was not detected at or above the reported result.
- J - The associated numerical result is an estimated quantity.

HOLDING TIMES

All analyses were performed within the method holding times.

CHECK STANDARDS

All recoveries are reasonable, acceptable, and within QC limits of 75% to 125%.

TRIPLICATE

Sample 168409 was analyzed in triplicate. The replicate analyses are within QC limits of 80% to 120% of the concentration of the original analysis.

MATRIX SPIKES

The matrix spike recovery is reasonable, acceptable, and within QC limits of 75% to 125%.

SUMMARY

All non-detect results have been qualified with a "U" to maintain consistency with Manchester Laboratory reporting protocol. This data is acceptable for use as amended.



STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive East • Port Orchard, Washington 98366-8204 • (206) 871-8860 • SCAN 871-8860

June 13, 1994

TO: Dale Norton
FROM: Bill Kammin, Environmental_Lab_Director **BK**
SUBJECT: Metals Quality Assurance memo for the Elliott Bay Project

SAMPLE INFORMATION

These samples from the Elliott Bay project were received by the Manchester Laboratory on 4/21/94 in good condition.

HOLDING TIMES

All analyses were performed within the USEPA Contract Laboratory Program (CLP) holding times for metals analysis (28 days for mercury, 180 days for all other metals).

INSTRUMENT CALIBRATION

Instrument calibration was performed before each analytical run and checked by initial calibration verification standards and blanks. Continuing calibration standards and blanks were analyzed at a frequency of 10% during the run and again at the end of the analytical run. All initial and continuing calibration verification standards were within the relevant USEPA (CLP) control limits. AA calibration gave a correlation coefficient (r) of 0.995 or greater, also meeting CLP calibration requirements.

PROCEDURAL BLANKS

The procedural blanks associated with these samples showed no analytically significant levels of analytes.

SPIKED SAMPLE ANALYSES

Spike and duplicate spike sample analyses were performed on this data set for mercury. For all other analytes, there was sufficient sample to perform only one spike, so no precision data is available. All spike recoveries were within the CLP acceptance limits of +/- 25%, with the following exceptions: silver, antimony and arsenic. For arsenic, the one spike was recovered at 74%, and all arsenic results are qualified with

N. The silver spike was recovered at 34%. The antimony spike was not recovered. Silver and antimony were qualified J, denoting estimates.

PRECISION DATA

Mercury spike/spike dup results showed acceptable precision. No spike/spike dup precision is available for other analytes.

LABORATORY CONTROL SAMPLE (LCS) ANALYSES

LCS analyses were within the windows established for each parameter, with the following exceptions: silver and antimony. Results for these analytes are qualified J, denoting estimated values.

SUMMARY

For all ICP and graphite furnace analytes, NIST 1646 and ERA #216 reference materials were analyzed. The ICP results are provided as attachments. For mercury NIST 2704 was analyzed several times. Furnace and mercury recoveries are as follows:

element	1646 % recovery	ERA #216 % recovery
arsenic	44%	110%
arsenic	42%	109%
cadmium	91%	102%
cadmium	80%	95%
	2704 % recovery	
mercury	97%	1.40 > 1.34 1.31
mercury	91%	

The data generated by the analysis of these samples can be used noting the data qualifications discussed in this memo.

Please call Bill Kammin at SCAN 206-871-8801 to further discuss this project.

WRK:wrk

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MANCHESTER ENVIRONMENTAL LABORATORY
7411 Beach Drive E, Port Orchard Washington 98366

CASE NARRATIVE

June 17, 1994

Subject: Elliott Bay WF Recontamination

Samples: 94 - 168404, -168409, -168419, -168423, -168428, -168436, -168445, -168450

Case No. DOE-080X

Officer: Dale Norton

By: Dickey D. Huntamer *DDH*
Organics Analysis Unit

POLYCHLORINATED BIPHENYLS

ANALYTICAL METHODS:

The soil samples were Soxhlet extracted with acetone following the Manchester modification of the EPA Method 8080 using dual column capillary GC analysis with Electron Capture Detectors (ECD). Normal QA/QC procedures were performed with the analyses. A pair of Canadian reference materials (HS-2) sample numbers 94-168453 and -168454, were also analyzed with the samples.

HOLDING TIMES:

The samples were extracted eleven days after they were received at the laboratory. All sample and extraction holding times were within the recommended limits.

BLANKS:

No target compounds were detected in the laboratory blanks.

SURROGATES:

All surrogate spike recoveries were within acceptable QC limits. Surrogates ranged from 43% to 114% recovery.

MATRIX SPIKE AND MATRIX SPIKE :

The matrix spikes recoveries ranged from 128% to 149%. The Relative Percent Differences (RPD) ranged from 0% to 4.6%. All recoveries and RPD were within acceptable QC limits.

SPECIAL ANALYTICAL PROBLEMS:

There were no significant problems with the Pesticide/PCB analysis. PCB-1260 was the only PCB detected and it was found in all of the samples.

DATA QUALIFIER CODES:

- U - The analyte was not detected at or above the reported value.
- J - The analyte was positively identified. The associated numerical value is an estimate.
- UJ - The analyte was not detected at or above the reported estimated result.
- REJ - The data are unusable for all purposes.
- EXP - The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals 3×10^6 .
- NAF - Not analyzed for.
- N - For organic analytes there is evidence the analyte is present in this sample.
- NJ - There is evidence that the analyte is present. The associated numerical result is an estimate.
- E - This qualifier is used when the concentration of the associated value exceeds the known calibration range.
- * - The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.)

MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive E, Port Orchard Washington 98366

CASE NARRATIVE


June 14, 1994

Subject: Elliott Bay WF Recontamination

Samples: 94 - 168404, -168409, -168414 to -168415, -168419, -168423, -168428, -168431, -
168436, -168445, -168450

Case No. DOE-080X

Officer: Dale Norton

By: Dickey D. Huntamer 
Organics Analysis Unit

SEMIVOLATILE ORGANICS**ANALYTICAL METHODS:**

The semivolatile soil samples were Soxhlet extracted with acetone following the Manchester modification of the EPA SW 846 8270 procedure with capillary GC/MS analysis of the sample extracts. The sample extracts were cleaned up prior to analysis using silica gel. By eluting with various mixtures of solvents the semivolatile target compounds could be recovered. Normal QA/QC procedures were performed with the analyses. A pair of Canadian reference materials (HS-6) sample numbers 94-168451 and -168452, were also analyzed with the samples.

HOLDING TIMES:

The samples were extracted eleven days after they were received at the laboratory. All sample and extraction holding times were within the recommended limits.

BLANKS:

Low levels of some target compounds were detected in the laboratory blanks. The EPA five times rule was applied to all target compounds which were found in the blank. Compounds that were found in the sample and in the blank were considered real and not the result of contamination if the levels in the sample are greater than or equal to five times the amount of compounds in the associated method blank.

SURROGATES:

The normal surrogate compounds were added to the sample prior to extraction. Surrogate spike recoveries were within acceptable QC limits. One surrogate, 1,2-dichlorobenzene-d4, dropped below 20% recovery in several samples. Since the remaining surrogates were acceptable no qualifiers were added.

MATRIX SPIKE AND MATRIX SPIKE DUPLICATE:

Matrix spike recoveries were within acceptable limits for most of the compounds. A number of the Polynuclear Aromatic Hydrocarbons (PAH) were found at high levels in the matrix source sample. Corrections to the matrix spikes for the native concentrations could not be made in all cases, resulting in erratic recoveries for some compounds. No qualifiers were added due to high recoveries. A "J" qualifier was added to results of matrix source sample, -168428, for those compounds where the recoveries were low.

Hexachlorocyclopentadiene was flagged as "REJ" since it was not recovered in the matrix spikes.

SPECIAL ANALYTICAL PROBLEMS:

As with the previous Elliott Bay sediment traps PAH's were the primary organic chemicals detected. The high concentrations of PAH in the matrix spike source sample -168428, interfered with the recovery calculations for some PAH's in the matrix spikes. The data is acceptable for use as qualified.

DATA QUALIFIER CODES:

- | | | |
|-----|---|--|
| U | - | The analyte was not detected at or above the reported value. |
| J | - | The analyte was positively identified. The associated numerical value is an <u>estimate</u> . |
| UJ | - | The analyte was not detected at or above the reported estimated result. |
| REJ | - | The data are <u>unusable</u> for all purposes. |
| EXP | - | The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals 3×10^6 . |
| NAF | - | Not analyzed for. |
| N | - | For organic analytes there is evidence the analyte is present in this sample. |
| NJ | - | There is evidence that the analyte is present. The associated numerical result is an estimate. |
| E | - | This qualifier is used when the concentration of the associated value exceeds the known calibration range. |
| * | - | The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.) |

**Battelle**

Pacific Northwest Division

Marine Sciences Laboratory
1529 West Sequim Bay Road
Sequim, Washington 98382-9099
Telephone (206) 683-4151
Facsimile (206) 681-3699

July 25, 1994

Mr. Stuart Magoon
Washington State Department
of Ecology
Manchester Laboratory
7411 Beach Drive East
Port Orchard, WA 98366-8204

Dear Stuart:

Enclosed are the results for Pb-210 in sediment samples received in May 1994.

The blanks are low. The blank spike recovery of Po208 (the internal standard) is consistent with these samples and previous batches of samples. The check sample is consistent with previous analyses. The precision for the duplicate is 14% RPD.

If you have any questions about the calculations, call Rob Cuello or me.

Enclosed are the raw data, digestion logs, and an invoice for the amount of \$1,650.

Sincerely,

Eric Crecelius
Technical Group Manager
Marine and Environmental Chemistry

:mkw

Enclosures

**THIRD QUARTER
PARTICULATE
MONITORING
DATA**

186

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

August 26, 1994

Project: **Elliot Bay Recontamination Study**

Samples: 298504, 298509, 298514, 298519, 298524, 298525, 298530, 298535,
298540, 298543, 298546, 298552, 298557

Laboratory: Weyerhaeuser Analytical and Testing Services 15472.

By: Karin Feddersen KF

These samples were received at the Manchester Laboratory on July 20, 1994, and were sent to Weyerhaeuser Analytical and Testing Services on July 25, 1994 for TOC analysis using PSEP.

HOLDING TIMES

The holding time for frozen sediments is six (6) months. There have been no studies performed to indicate the effect of holding time on samples that have not been stored frozen prior to analysis. Therefore an evaluation of the results with regard to holding time is not feasible. All samples were stored in the proper containers at 4 degrees C until analysis. All analyses were performed within twenty-nine (29) days of collection.

PROCEDURAL BLANKS

The procedural blanks associated with these samples demonstrated that the processes were free from contamination.

INITIAL CALIBRATION

The % Relative Standard Deviation (%RSD) was within QC limits of $\leq 20\%$.

CHECK STANDARDS

All Check Standard recoveries are reasonable, acceptable, and within QC limits of 90% to 110%.

REPLICATES

The Relative Percent Difference (RPD) of the replicate analyses to the original analyses are within QC limits of $\leq 10\%$.

SUMMARY

This data is acceptable for use as amended.

counter
particulates
1872

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

September 6, 1994

Project: Elliott Bay Recontamination

Samples: 298504,09,14,19,24,25,30,35,40,43,46,52,57

Laboratory: Soil Technology

By: Pam Covey *jk*

The Elliott Bay Recontamination samples required thirteen (13) Grain Size analyses on sediment using Puget Sound Estuary Protocol (P.S.E.P) protocol with salt correction.

These samples were received at the Manchester Environmental Laboratory on July 21, 1994 and transported to Soil Technology on July 26, 1994 for Grain Size analyses. These analyses were reviewed for qualitative and quantitative accuracy, validity and usefulness.

The results are acceptable for use as reported.

S.O.P. Salt Correction Pipette Total Dissolved Solids

The following protocol is used for correction of dissolved solids (salt correction) in the pipette portion of grain size determination. Upon completion of the silt-clay fractions by the pipette technique, a subsample of approximately 200 ml of water is taken from the 1 liter graduated flask and placed in a centrifuge bottle and spun at 9000 rpm for 15 minutes. Then a 20 ml subsample of the supernatant is filtered through a .45 micron filter into a pre-weighed container. This sample is dried overnight at 90° C and re-weighed. The resultant residue represents the amount of dissolved salts and dispersant present in a 20 ml sample. This weight of dispersant and dissolved solids is subtracted from the weight of each sediment fraction at the end of the pipette analysis.

Samples were tested in general accordance with Puget Sound Estuary Protocol (Conventional Sediment Variables Particle Size, March 1986) and EPA, US Army Corps of Engineers "Dredge Material Testing Manual, February 1991". According to this method, the determination of parameters in sediment and water from estuarine or marine environments have to explicitly address steps taken to control salt interference. Steps were taken to correct for salt interference and these corrections are referred to as dissolved solids.



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STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive East • Port Orchard, Washington 98366-8204 • (206) 871-8860 • SCAN 871-8860

September 8, 1994

TO: Dale Norton

FROM: Bill Kammin, Environmental_Lab_Director *BK*

SUBJECT: Metals Quality Assurance memo for the Week 29 Elliott Bay Sampling Project

SAMPLE INFORMATION

These samples from the Week 29 Elliott Bay project were received by the Manchester Laboratory on 7/21/94 in good condition.

HOLDING TIMES

All analyses were performed within the USEPA Contract Laboratory Program (CLP) holding times for metals analysis (28 days for mercury, 180 days for all other metals).

INSTRUMENT CALIBRATION

Instrument calibration was performed before each analytical run and checked by initial calibration verification standards and blanks. Continuing calibration standards and blanks were analyzed at a frequency of 10% during the run and again at the end of the analytical run. All initial and continuing calibration verification standards were within the relevant USEPA (CLP) control limits. AA calibration gave a correlation coefficient (r) of 0.995 or greater, also meeting CLP calibration requirements.

PROCEDURAL BLANKS

The procedural blanks associated with these samples showed no analytically significant levels of analytes.

SPIKED SAMPLE ANALYSES

Spike and duplicate spike sample analyses were performed on this data set. Several spike recoveries were outside the CLP acceptance limits of +/- 25%. Analyte levels for the sample chosen for the ICP spike were higher than the spiking levels for several analytes. Also, the sample chosen for spiking shows some degree of non-homogeneity.



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Several analytes are qualified with N, denoting low spike recoveries. In addition, the concentration of several analytes was greater than four times the spiking level used. In these cases, per EPA protocol, spike recoveries are not calculated.

In some cases, sample levels were two to three times the spiking level used. This also may contribute to the poor spike recovery found.

PRECISION DATA

The results of the spike and duplicate spike samples were used to evaluate precision on this sample set. The Relative Percent Difference (RPD) for all analytes was within the 20% CLP acceptance window for duplicate analysis.

LABORATORY CONTROL SAMPLE (LCS) ANALYSES

LCS (Environmental Resource Associates (ERA) lot number 216) analyses were within the acceptance windows established for each parameter, with one exception: silver. Silver results for this project are qualified J, denoting estimated values. Spreadsheets of the ICP evaluation of the ERA LCS are provided with this report.

REFERENCE MATERIAL ANALYSES

NIST 1646 was analyzed in duplicate by project officer request. Results were typical for the environmental digestion methods on this geologically evaluated reference material. Spreadsheets of the ICP evaluation of NIST 1646 are provided with this report. For mercury, NIST 2704 was analyzed in replicate, with recoveries at 100%, 100%, 100%, 98%, 99%, and 97%. Also for mercury, NIST 1646 was analyzed, with recoveries at 118% and 119%. For this project, cadmium and arsenic were analyzed by GFAA. For cadmium, recoveries of NIST 1646 were 96% and 98%. For arsenic, recoveries of NIST 1646 were at 51% and 51%.

SUMMARY

Dale, next time we analyze Elliott Bay samples we will use a higher level spike, because of the spiking issues associated with this project. It's possible that high sulfide in the sample spiked could have interfered with the spike recoveries.

The data generated by the analysis of these samples can be used noting the data qualifications discussed in this memo.

Please call Bill Kammin at SCAN 206-871-8801 to further discuss this project.

WRK:wrk

MANCHESTER ENVIRONMENTAL LABORATORY
7411 Beach Drive E , Port Orchard Washington 98366

CASE NARRATIVE

August 12, 1994

Subject: Elliott Bay Recontamination

Samples: 94 - 298504, -298509, -298514, -298519, -298524, -298525, -298530, -298535, -298540, -298543, -298546, -298552, and -298557 to -298559

Case No. DOE-155W

Officer: Dale Norton

By: Dickey D. Huntamer
Organics Analysis Unit

POLYCHLORINATED BIPHENYLS

ANALYTICAL METHODS:

The samples were Soxhlet extracted using acetone as the solvent. Analysis was done by EPA Method 8080 using dual column capillary GC analysis with Electron Capture Detectors (ECD).

HOLDING TIMES:

All sample extraction and analysis holding times were met.

BLANKS:

No target compounds were detected in the laboratory blanks.

SURROGATES:

The surrogate spike recoveries ranged from 38% to 108%. Sample -298535 had two surrogate compounds below 50% and samples, -298530 LMX1, -298558 and -298559 each had one surrogate below 50% recovery. Since at least two surrogates had acceptable recoveries in each sample no qualifiers were added to sample results.

MATRIX SPIKE AND MATRIX SPIKE :

The matrix spikes recoveries ranged from 62% to 94%. The Relative Percent Differences (RPD) ranged from 25% to 27%. All recoveries and RPD were within acceptable QC limits.

ANALYTICAL COMMENTS:

There were no significant problems with the PCB analysis and the data is acceptable for use as qualified. Samples -298558 and -298559 were Canadian reference material analyzed in duplicate.

DATA QUALIFIER CODES:

- U - The analyte was not detected at or above the reported value.
- J - The analyte was positively identified. The associated numerical value is an estimate.
- UJ - The analyte was not detected at or above the reported estimated result.
- REJ - The data are unusable for all purposes.
- EXP - The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals 3×10^6 .
- NAF - Not analyzed for.
- N - For organic analytes there is evidence the analyte is present in this sample.
- NJ - There is evidence that the analyte is present. The associated numerical result is an estimate.
- E - This qualifier is used when the concentration of the associated value exceeds the known calibration range.
- * - The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.)

MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive E, Port Orchard Washington 98366

CASE NARRATIVE

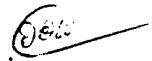
September 26, 1994

Subject: Elliott Bay Recontamination

Samples: 94 - 29804, -298509, -298514, -298519, -298524, -298525, -298530, -298535, -298540, -298543, -298546, -298552, -298557, -298560 and -298561.

Case No. DOE-155W

Officer: Dale Norton

By: Dickey D. Huntamer 
Organics Analysis Unit

SEMIVOLATILE ORGANICS**ANALYTICAL METHODS:**

The semivolatile sediment samples were Soxhlet extracted with acetone following the Manchester modification of the EPA SW 846 8270 procedure with capillary GC/MS analysis of the sample extracts. Normal QA/QC procedures were performed with the analyses.

HOLDING TIMES:

All sample and extraction holding times were within the recommended limits.

BLANKS:

Low levels of some target compounds were detected in the laboratory blanks. The EPA five times rule was applied to all target compounds which were found in the blank. Compounds that were found in the sample and in the blank were considered real and not the result of contamination if the levels in the sample are greater than or equal to five times the amount of compounds in the associated method blank.

SURROGATES:

The normal surrogate compounds were added to the sample prior to extraction. No surrogate recovery limits have been established for semivolatile analysis using the silica gel cleanup procedure. Generally the silica gel cleanup would result in lower recoveries of the more polar compounds. This appears to be the case for the phenolic surrogates, 2-fluorophenol and d5-phenol, which fell below the CLP lower recovery limits of 25% and 24% respectively. Since these samples had the additional cleanup no data qualifiers were added due to surrogate recoveries.

K0 195
3.10 3 months
for Pb-210

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366
December 16, 1994

Project: **Elliot Bay Recontamination**

Samples: 268500 - 268511, 268518 - 268530, 268537 - 268549, 268560, 268561, 298504, 298509, 298514, 298519, 298524, 298525, 298530, 298535, 298540, 298543, 298546, 298552, 298557

Laboratory: Battelle Marine Sciences Laboratory 747EB

By: Karin Feddersen **KF**

These samples arrived at Manchester Environmental Laboratory on June 29 and July 21, 1994, and were sent to Battelle on June 30 and July 26, 1994, for Lead 210 and Cesium 137 analysis.

PROCEDURAL BLANKS:

There was a considerable amount of background noise observed for those samples analyzed for Cs 137. An air blank was not analyzed for Pb 210 with the samples from week 26. For the necessary blank correction, the air blank analyzed with the week 29 samples several months earlier was used. Some instrument adjustments occurred in the intervening time which may have affected the results for these analyses.

CHECK STANDARDS:

QC limits for these recoveries have not been established for these analyses.

REPLICATE:

Samples 268507, 268538, and 298552 were analyzed in duplicate for Pb 210. Samples 268537 and 268560 were analyzed in duplicate for Cs 137. Precision and accuracy data have not been established for these analyses. The replicate Cs 137 result for sample 268537 appeared much lower than the original result. The analyst explained that although the RPD was 75%, since the results were "so low", she did not judge it necessary to reanalyze the sample. She offered to reanalyze one of the more active samples in duplicate, and send the results next week.

SAMPLE SUMMARY:

Samples 268528, 268538R (replicate), and 268530 exhibited poor peak response and have therefore each been qualified with a "J" (estimated results). This data is acceptable for use as amended.

**FOURTH QUARTER
PARTICULATE
MONITORING
DATA**

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State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366
November 17, 1994

Project: **Elliot Bay Recontamination Study**

Samples: 428404, 42847, 428412, 428415, 428418, 428423, 428424, 428429, 428434,
428443, 428449, 428454

Laboratory: Sound Analytical Services, Inc. 44115

By: Karin Feddersen KF

These samples were received at the Manchester Laboratory on October 21, 1994, and were sent to Sound Analytical Services, Inc. on October 26, 1994 for TOC analysis using the following methods: Puget Sound Estuary Program.

HOLDING TIMES

The PSEP TOC holding time for frozen sediments is six (6) months. No studies to my knowledge have been performed to indicate the effect of holding time on samples that have not been stored frozen prior to analysis. Therefore an evaluation of the results with regard to holding time is not feasible. The samples were stored in the proper containers at 4 degrees C until analysis.

PROCEDURAL BLANKS

The procedural blanks associated with these samples have demonstrated that the processes are free from contamination.

CHECK STANDARDS

All recoveries were within QC limits of 75% to 125% of the true value.

TRIPLICATE:

Samples 428404 was analyzed in triplicate. The % Relative Standard Deviation (RSD) is within QC limits of 20%.

SUMMARY

For consistency with Manchester Laboratory reporting protocol, all non-detect results have been qualified with a "U" - "The analyte was not detected at or above the reported result". This data is acceptable for use as amended.

MATRIX SPIKE AND MATRIX SPIKE DUPLICATE:

Matrix spikes were extracted with these samples however one matrix spike was lost in a laboratory accident and consequently only one matrix spike is reported. Recoveries were generally good with the exception of a few compounds such as the nitroanilines, hexachloroethane and hexchlorocyclopentadiene. A number of the polynuclear aromatic hydrocarbon (PAH) compounds had elevated recoveries due to the high native concentrations present in the matrix source sample which could not be subtracted out.

ANALYTICAL COMMENTS:

High PAH concentrations were found in the samples. Other than the problem with the loss of the one matrix spike no special analytical problems were encountered in the semivolatile analyses. Samples, -298560 and -298561 are Canadian Reference Material HS-6 analyzed in duplicate.

DATA QUALIFIER CODES:

- U - The analyte was not detected at or above the reported value.
- J - The analyte was positively identified. The associated numerical value is an estimate.
- UJ - The analyte was not detected at or above the reported estimated result.
- REJ - The data are unusable for all purposes.
- EXP - The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals 3×10^6 .
- NAF - Not analyzed for.
- N - For organic analytes there is evidence the analyte is present in this sample.
- NJ - There is evidence that the analyte is present. The associated numerical result is an estimate.
- E - This qualifier is used when the concentration of the associated value exceeds the known calibration range.
- * - The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.)

H - Quarter
Particulates 1996

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

November 17, 1994

Project: Elliott Bay

Samples: 42-8404,12,15,18,23,24,29,34,39,43,49,54

Laboratory: Soil Technology

By: Pam Covey *PC*

Case Summary

The Elliott Bay samples required twelve (12) Grain Size analyses on sediment using Puget Sound Estuary Program Protocol.

These samples were received at the Manchester Environmental Laboratory on October 21, 1994 and transported to Soil Technology on October 27, 1994 for Grain Size analyses. These analyses were reviewed for qualitative and quantitative accuracy, validity and usefulness.

The results are acceptable for use as reported.

MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive E , Port Orchard Washington 98366

CASE NARRATIVE**December 28, 1994**

Subject: Elliott Bay Recontamination

Samples: 94 - 428404, -428407, -428412, -428415, -428418, -428423, -428424, -428429, -428434, -428439, -428443, -428449 and -428454

Case No. 150094

Officer: Dale Norton

By: Dickey D. Huntamer *DDH*
Organics Analysis Unit

SEMIVOLATILE ORGANICS**ANALYTICAL METHODS:**

The semivolatile sediment samples were Soxhlet extracted with acetone following the Manchester modification of the EPA SW 846 8270 procedure including a full semivolatile silica-gel cleanup procedure with capillary GC/MS analysis of the sample extracts. Normal QA/QC procedures were performed with the analyses.

HOLDING TIMES:

All sample and extraction holding times were within the recommended limits.

BLANKS:

Low levels of some target compounds were detected in the laboratory blanks. The EPA five times rule was applied to all target compounds which were found in the blank. Compounds that were found in the sample and in the blank were considered real and not the result of contamination if the levels in the sample are greater than or equal to five times the amount of compounds in the associated method blank.

SURROGATES:

The normal surrogate compounds were added to the sample prior to extraction. No surrogate recovery limits have been established for semivolatile analysis using the silica gel cleanup procedure. Generally the silica gel cleanup would result in lower recoveries of the more polar compounds. Surrogate recoveries were within acceptable limits for all samples except -428407 which had no recovery of d5-phenol, 2-fluorophenol and d4-2-chlorophenol. All results for the phenols in sample -428407 were given the "J" qualifier.

MATRIX SPIKE AND MATRIX SPIKE DUPLICATE:

Matrix spikes were generally acceptable except for 1,3 and 1,2 dichlorobenzenes, benzyl alcohol, hexachloroethane, 3-nitroaniline, 4-nitrophenol, and 4-nitroaniline which were given the "J" qualifier in the matrix source sample, -428449. Results for two other compounds, 4-chloroaniline and hexachlorocyclopentadiene in sample -428449, were rejected "REJ" due to no recoveries.

ANALYTICAL COMMENTS:

High PAH concentrations were found in the samples and were primarily responsible for the elevated quantitation limits. There appeared to be some carry over into the blank, possibly from the GPC or the GC autosampler. This resulted in the raising of quantitation limits for some compounds. Samples, HS-6A and HS-6B are Canadian Reference Material HS-6 analyzed in duplicate. The data is acceptable for use as qualified.

DATA QUALIFIER CODES:

- U - The analyte was not detected at or above the reported value.
- J - The analyte was positively identified. The associated numerical value is an estimate.
- UJ - The analyte was not detected at or above the reported estimated result.
- REJ - The data are unusable for all purposes.
- EXP - The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals 3×10^6 .
- NAF - Not analyzed for.
- N - For organic analytes there is evidence the analyte is present in this sample.
- NJ - There is evidence that the analyte is present. The associated numerical result is an estimate.
- E - This qualifier is used when the concentration of the associated value exceeds the known calibration range.
- bold** - The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.)

MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive E, Port Orchard Washington 98366

CASE NARRATIVE

December 13, 1994

Subject: Elliott Bay Recontamination

Samples: 94 - 428404, -428407, -428412, -428415, -428418, -428423, -428424, -428429
-428434, -428439, -428443, -428449, -428454 to -428456

Case No. DOE-155Y

Officer: Dale Norton

By: Dickey D. Huntamer (DDH)
Organics Analysis Unit

POLYCHLORINATED BIPHENYLS**ANALYTICAL METHODS:**

The soil sample was Soxhlet extracted using acetone as the solvent. Analysis was done by EPA Method 8080 using dual column capillary GC analysis with Electron Capture Detectors (ECD).

HOLDING TIMES:

All sample extraction and analysis holding times were met.

BLANKS:

No target compounds were detected in the laboratory blanks.

SURROGATES:

Surrogates ranged from 13% to 86% recovery. Surrogate recovery for Dibutylchlorodate (DBC) is not reported in the matrix spikes. DBC is prone to interference from high PCB sample or spike concentrations and has low recoveries in the normal Florisil PCB clean up procedure. Decachlorobiphenyl (DCB) is the surrogate most representative of the PCB target compounds. All recoveries for DCB were acceptable and consequently no additional qualifiers were added to the data..

MATRIX SPIKE AND MATRIX SPIKE :

The matrix spikes recoveries ranged from 69% to 96%. The Relative Percent Differences (RPD) ranged from 4.3% to 8.7%. All recoveries and RPD were within acceptable QC limits.

ANALYTICAL COMMENTS:

No analytical problems were encountered in the analysis. the data is acceptable for use as qualified.

DATA QUALIFIER CODES:

- U - The analyte was not detected at or above the reported value.
- J - The analyte was positively identified. The associated numerical value is an estimate.
- UJ - The analyte was not detected at or above the reported estimated result.
- REJ - The data are unusable for all purposes.
- EXP - The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals 3×10^6 .
- NAF - Not analyzed for.
- N - For organic analytes there is evidence the analyte is present in this sample.
- NJ - There is evidence that the analyte is present. The associated numerical result is an estimate.
- E - This qualifier is used when the concentration of the associated value exceeds the known calibration range.
- * - The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.)



STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive East • Port Orchard, Washington 98366-8204 • (206) 895-4737 • SCAN 744-4737

November 30, 1994

TO: Dale Norton, Project Officer

FROM: Myrna McIntosh, Metals Analyst *ML*

SUBJECT: Metals Quality Assurance memo for the Elliot Bay Recontamination Project
Sample Numbers: 94428404 - 94428454

SAMPLE INFORMATION

The samples from the Elliot Bay Recontamination project were received by the Manchester Laboratory on 10/21/94 in good condition. The samples were analyzed by the following methods: ICP EP1-200.7, Arsenic EP1-206.2, Cadmium EP1-213.2, Mercury EP1-245.5.

HOLDING TIMES

All analyses were performed within the USEPA Contract Laboratory Program (CLP) holding times for metals analysis (28 days for mercury, 180 days for all other metals).

INSTRUMENT CALIBRATION

Instrument calibration was performed before each analytical run and checked by initial calibration verification standards and blanks. Continuing calibration standards and blanks were analyzed at a frequency of 10% during the run and again at the end of the analytical run. All initial and continuing calibration verification standards were within the relevant USEPA (CLP) control limits. AA calibration gave a correlation coefficient (r) of 0.995 or greater, also meeting CLP calibration requirements.

PROCEDURAL BLANKS

The procedural blanks associated with these samples show no analytically significant levels of analytes.

SPIKED SAMPLE ANALYSES

Spiked and duplicate spiked sample analyses were performed on this data set. All spike recoveries are within the CLP acceptance limits of $\pm 25\%$, except for silver and arsenic. The arsenic values are qualified with "N". The silver results are qualified with "J" since the recoveries had poor precision and the LCS was low.

PRECISION DATA

The results of the spiked and duplicate spiked samples are used to evaluate precision on this sample set. The Relative Percent Difference (RPD) for all analytes, except silver is within the 20% CLP acceptance window for duplicate analysis.

LABORATORY CONTROL SAMPLE (LCS) ANALYSES

LCS analyses are within the windows established for each parameter, with the exception of silver.

SUMMARY

The data generated by the analysis of these samples can be used noting the data qualifications discussed in this memo.

Please call Bill Kammin at SCAN 206-871-8801 to further discuss this project.

MMM:mmm

**BOTTOM CORE
MONITORING
DATA**

206

Bottom Sediment
Surface Samples

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

Data Review
July 26, 1994

Project: **Elliott Bay Recontamination**

Samples: 268512, 8531, 8550, 8558

Laboratory: Soil Technology

By: Pam Covey *pc*

Case Summary

The review is for sediment grain size using Puget Sound Estuary Program (P.S.E.P.) protocol.

These samples were received at the Manchester Environmental Laboratory on June 29, 1994. They were transported to Soil Technology on July 1, 1994 for Grain Size analysis. These analyses were reviewed for qualitative and quantitative accuracy, validity, and usefulness.

The results are acceptable for use as reported.

Elliott Bay Recon.

Case Narrative

Due to variations in water content between the subsamples taken for moisture content and grain size analysis, sample **268558** required calculation of the weight of solids using Folk's method (*Petrology of Sedimentary Rocks*, R.L. Folk, 1974). Insufficient sample quantity prohibited resampling for determination of solids by the standard method (based on subsample water content). Folk's weight of solids calculation adds the dry weight of the sample retained on the sieves (+ #230 sieve; > 62.5 microns) to the dry weight of the first pipet (4 phi) corrected for the volume of the cylinder and dispersant concentration.

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366
August 8, 1994

Project: **Elliot Bay Recontamination Study**
Samples: 268512, 268531, 268550, 268558
Laboratory: Sound Analytical Services, Inc. 41453
By: Karin Feddersen **KF**

These samples were received at the Manchester Laboratory on June 28, 1994, and were sent to Sound Analytical Services, Inc. on June 30, 1994 for TOC analysis using the following method: Puget Sound Estuary Program

DATA QUALIFIER DEFINITIONS

U - The analyte was not detected at or above the reported result.

HOLDING TIMES

The PSEP TOC holding time for frozen sediments is six (6) months. No studies to my knowledge have been performed to indicate the effect of holding time on samples that have not been stored frozen prior to analysis. Therefore an evaluation of the results with regard to holding time is not feasible. The samples were stored in the proper containers at 4 degrees C until analysis.

PROCEDURAL BLANKS

The procedural blanks associated with these samples have demonstrated that the process is free from contamination.

CHECK STANDARDS

All recoveries were within QC limits of +/- 20%.

TRIPPLICATE

Sample 268512 was analyzed in triplicate. The triplicate analyses are in acceptable agreement with the original analysis. The Relative Percent Difference (RPD) was within the +/- 20% window for triplicate analyses.

SUMMARY

For consistency with Manchester Environmental Laboratory reporting requirements, all non-detect values have been modified to reflect the detection limit and have been qualified with a "U".

This data is acceptable for use as amended.

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MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive E , Port Orchard Washington 98366

CASE NARRATIVE

August 12, 1994

Subject: Elliott Bay Recontamination

Samples: 94 - 268512 to -268517, -268531 to -268536, -268550 to -268558 and -268559

Case No. DOE-155X

Officer: Dale Norton

By: Dickey D. Huntamer *[Signature]*
Organics Analysis Unit

POLYCHLORINATED BIPHENYLS

ANALYTICAL METHODS:

The sediment samples were Soxhlet extracted using acetone as the solvent. Analysis was done by EPA Method 8080 using dual column capillary GC analysis with Electron Capture Detectors (ECD).

HOLDING TIMES:

All sample extraction and analysis holding times were met.

BLANKS:

No target compounds were detected in the laboratory blanks.

SURROGATES:

The surrogate spike recoveries were generally within acceptable QC limits. Surrogates ranged from 49% to 110% recovery for all samples except, -268535 where decachlorobiphenyl (DCB) had 145% recovery. Surrogate recoveries for sample, -268551, were low due to a crack in the Soxhlet extractor and some sample extract loss. The results for sample, -268551 were given the "J" qualifier to indicate that the quantification results are estimates.

MATRIX SPIKE AND MATRIX SPIKE :

The matrix spikes recoveries ranged from 64% to 71%. The Relative Percent Differences (RPD) ranged from 10.4% to 17%. All recoveries and RPD were within acceptable QC limits.

ANALYTICAL COMMENTS:

There were no significant problems with the PCB analysis and the data is acceptable for use as qualified. Sample -268512 exhibited a strong creosote like odor and had an oily extract.

DATA QUALIFIER CODES:

- U - The analyte was not detected at or above the reported value.
- J - The analyte was positively identified. The associated numerical value is an estimate.
- UJ - The analyte was not detected at or above the reported estimated result.
- REJ - The data are unusable for all purposes.
- EXP - The result is equal to the number before EXP times 10 to the power of the number after EXP. As an example 3EXP6 equals 3×10^6 .
- NAF - Not analyzed for.
- N - For organic analytes there is evidence the analyte is present in this sample.
- NJ - There is evidence that the analyte is present. The associated numerical result is an estimate.
- E - This qualifier is used when the concentration of the associated value exceeds the known calibration range.
- * - The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.)

**BOTTOM CORE
METALS**



STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

MANCHESTER ENVIRONMENTAL LABORATORY

7411 Beach Drive East • Port Orchard, Washington 98366-8204 • (206) 871-8860 • SCAN 871-8860

August 19, 1994

TO: Dale Norton

FROM: Bill Kammin, Environmental_Lab_Director *BK*

SUBJECT: Metals Quality Assurance memo for the Elliott Bay Project

SAMPLE INFORMATION

These samples from the Elliott Bay project were received by the Manchester Laboratory on 6/29/94 in good condition.

HOLDING TIMES

All analyses were performed within the USEPA Contract Laboratory Program (CLP) holding times for metals analysis (28 days for mercury, 180 days for all other metals).

INSTRUMENT CALIBRATION

Instrument calibration was performed before each analytical run and checked by initial calibration verification standards and blanks. Continuing calibration standards and blanks were analyzed at a frequency of 10% during the run and again at the end of the analytical run. All initial and continuing calibration verification standards were within the relevant USEPA (CLP) control limits. AA calibration gave a correlation coefficient (r) of 0.995 or greater, also meeting CLP calibration requirements.

PROCEDURAL BLANKS

The procedural blanks associated with these samples showed no analytically significant levels of analytes.

SPIKED SAMPLE ANALYSES

Spike and duplicate spike sample analyses were performed on this data set. All spike recoveries were within the CLP acceptance limits of +/- 25%, with the following exception: lead and zinc. The spiked sample for lead showed considerable non-homogeneity, with precision at 22% (RPD). Lead results are qualified with J, denoting estimated values. One of the zinc spikes was recovered outside the +/- 25%.

acceptance window, so zinc results were qualified with N. Per EPA CLP protocols, the major analytes aluminum, iron, and magnesium were not spiked.

For mercury, the initial spiking level was miniscule in relation to the level of mercury in the sample. The analyst respiked one of the samples at 20 times the lab normal spiking level and found acceptable recoveries.

PRECISION DATA

The results of the spike and duplicate spike samples were used to evaluate precision on this sample set. The Relative Percent Difference (RPD) for all analytes was within the 20% CLP acceptance window for duplicate analysis, with the following exception: lead.

REFERENCE MATERIAL ANALYSES

The project requested analysis of NIST 1646, a highly mineralized estuarine sediment, in support of this project. NIST 1646 is generally not well recovered by the environmental sample preparation methods for metals. ICP recoveries for 1646 were typical (see attached spreadsheets). Also analyzed by ICP was ERA material #216. Recoveries for ERA material 216 were acceptable.

For mercury in sediment NIST 2704 (Buffalo River Sediment) is analyzed with every run. 2704 recoveries for this run were 106%, 105%, 106% and 105%. NIST 1646 was also analyzed, giving slightly high recoveries, 139% and 137%. It is possible that this standard needs recertification for mercury, as these results are very similar to results that Battelle Sequim is obtaining for this same standard.

SUMMARY

The data generated by the analysis of these samples can be used noting the data qualifications discussed in this memo.

Please call Bill Kammin at SCAN 206-871-8801 to further discuss this project.

WRK:wrk

	Hg	% Rec
1.44	1.53	106
2704	1.51	105
	1.52	106
		105

.003	1646	.058
		.056
		.097

**AANDERRA
CURRENT
METERS**

FIRST QUARTER

DATA QUALITY EVALUATION

2/6

AANDERAA INSTRUMENTS LTD.

1 ALPHA STREET
VICTORIA, BRITISH COLUMBIA
CANADA V8Z 1B2
TELEPHONE (604) 386-7783

CUSTOMER Washington State Department of Ecology
Olympia, WA 98504-7612
Atten: Dale Norton

Instrument RCM4 Serial No. 7207 Tape No. 1

Words 52662 Samples 8777 Errors 0 Sync errors 0

Expected number of samples (calculated from start/ stop times) Uncertain of correct start/cast/stop times.

Physical tape problem(s) None ☒

Insufficient leader/ trailer (should have 15 turns) ☐

Other _____

Instrument problem None ☒

Problem _____

Probable cause _____

Recommended action _____

Date February 3, 1994 Signed Jared C. Bauer

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DATA QUALITY EVALUATION

AANDERAA INSTRUMENTS LTD.

1 ALPHA STREET
VICTORIA, BRITISH COLUMBIA
CANADA V8Z 1B2
TELEPHONE (604) 386-7783

CUSTOMER Washington State Department of Ecology

Olympia, WA 98504-7612

Atten: Dale Norton

Instrument RCM4 Serial No. 7228 Tape No. 1

Words 47376 Samples 7896 Errors 0 Sync errors 0

Expected number of samples (calculated from start/ stop times) Uncertain of correct start/cast/stop times.

Physical tape problem(s) None ☒

Insufficient leader/ trailer (should have 15 turns) ☐

Other _____

Instrument problem None ☒

Problem _____

Probable cause _____

Recommended action _____

Date February 3, 1994

Signed

David R. Bauer

DATA QUALITY EVALUATION

248

AANDERAA INSTRUMENTS LTD.

3 ALPHA STREET
VICTORIA, BRITISH COLUMBIA
CANADA V8Z 1B2
TELEPHONE (604) 386-7783

CUSTOMER Washington State Department of Ecology
Olympia, WA 98504-7612
Atten: Dale Norton

Instrument RCM4 Serial No. 7689 Tape No. 1

Words 48492 Samples 8082 Errors 1 Sync errors 3

Expected number of samples (calculated from start/ stop times) Uncertain of correct start/cast/stop times.

Physical tape problem(s) None ☐

Insufficient leader/ trailer (should have 15 turns) ☐

Other Edge of tape was slightly stretched - caused signal strength to vary.

Sample # 3696 - speed channel had word error and sync error.

(likely due to imperfection in tape)

Sample # 7856 - temperature reading missed - inserted '527'

(same number as above and below sample # 7856)

Sample # 8073 - reference reading dropped - inserted '54'

Instrument problem None ☐

Problem _____

Probable cause _____

Recommended action Advise check of tape transport alignment/spoolholder tensions.

Date February 3, 1994 Signed David R. Bauer

DATA QUALITY EVALUATION

AANDERAA INSTRUMENTS LTD.

7 ALPHA STREET
 TORIA, BRITISH COLUMBIA
 CANADA V8Z 1B2
 TELEPHONE (604) 386-7783

CUSTOMER Washington Department of EcologyOlympia, WA 98504-7612Atten: Dale NortonInstrument RCM4 Serial No. 7690 Tape No. 1Words 45144 Samples 7524 Errors 0 Sync errors 35Expected number of samples (calculated from start/ stop times) Uncertain of correct start/cast/stop times.Physical tape problem(s) None ☒Insufficient leader/ trailer (should have 15 turns) ☐

Other _____

Instrument problem None ☐

Problem Lack of sync pulse. Without a sync pulse, instrument did not stop recording to wait for next interval. Caused excess data to be recorded in between proper data sets - lead to tape running out before deployment end. Excess data removed from samples # 965/967/969/1008/1075/1076/1077/1108/1995/2220/3769/4354/4397/4401/4402/4545/4546/4548/4920/5407/5409/5476/5533/5574/5576/5638/7509/7510/7512/7513/7515/7517/7521/7523/7524. Original and altered files stored.

Probable cause Channel selector/encoder alignment changed during shipment or deployment due to excess vibration.

Recommended action Re-adjust channel selector/encoder alignment - center channel selector in mounting hole and test.

Date February 3, 1994Signed David R. Bauer

DATA QUALITY EVALUATION

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AANDERAA INSTRUMENTS LTD.

7 ALPHA STREET
VICTORIA, BRITISH COLUMBIA
CANADA V8Z 1B2
TELEPHONE (604) 386-7783

CUSTOMER Washington State Department of Ecology
Olympia, WA 98504-7612
Atten: Dale Norton

Instrument RCM4 Serial No. 7693 Tape No. 1
Words 52086 Samples 8681 Errors 2 Sync errors 3

Expected number of samples (calculated from start/ stop times) Uncertain of start/cast/stop times.

Physical tape problem(s) None ☐

Insufficient leader/ trailer (should have 15 turns) Tape ran out or was cut too close to end of data. ☐

Other Unable to read last 8" of tape. Only errors occurred at end of tape when tape tension on readout head was lost.

Instrument problem None ☒

Problem _____

Probable cause _____

Recommended action Ensure at least 15 turns of tape are left at beginning and end of data.

Date February 3, 1994

Signed

Dale R. Bauer

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DATA QUALITY EVALUATION

AANDERAA INSTRUMENTS LTD.

ALPHA STREET
VICTORIA, BRITISH COLUMBIA
CANADA V8Z 1B2
TELEPHONE (604) 386-7783

CUSTOMER Washington State Department of Ecology

Olympia, WA 98504-7612

Atten: Dale Norton

Instrument RCM4 Serial No. 7695 Tape No. 1

Words 47970 Samples 7995 Errors 0 Sync errors 0

Expected number of samples (calculated from start/ stop times) Uncertain of start/cast/stop times.

Physical tape problem(s) None ☒

Insufficient leader/ trailer (should have 15 turns) ☐

Other _____

Instrument problem None ☒

Problem _____

Probable cause _____

Recommended action _____

Date February 3, 1994 Signed Jawid R. Bauer

SECOND QUARTER

223

2nd quarter Monitoring
Results

**Tape Translation Data Quality Evaluation
for
Washington State Department of Ecology**

May 8, 1994

After reading the data from the seven (7) tapes sent for translation, a data quality evaluation was performed. Enclosed are the graph printouts for the temperature, conductivity, direction and speed raw data.

The data disk contains 3 self-extracting compressed files. The data can be retrieved by copying the file to the directory you wish the data to be stored and executing the file. The 3 files are as follows:

rcm-raw.exe	-	contains data as read from tape.
rcm-mod.exe	-	contains error 'corrected' data.
rcm-eng.exe	-	contains engineering data files.

Following are descriptions of data quality:

RCM 7207	-	8717 samples read, 1 word and 1 sync errors. Sample # 4296 missed conductivity reading - inserted 0 to align remaining columns.
RCM 7228	-	9024 samples read, 0 word and 1 sync errors. Sample # 1 missed reference and temperature readings - suspect that channel selector was advanced past channel 2 on start up. Inserted reference and average temperature reading.
RCM 7689	-	8757 samples read, 52362 word and 34 sync errors. Almost every word was marked as error indicating inconsistent bit pulse width. Data looks consistent and usable - suspect encoder cap geometry has changed due to vibration or age. Suggest full servicing for instrument.

Sample #/Changes

3716	-	inserted ref.
8278	-	removed 511 in ch. 5
8529	-	inserted 1023 in ch. 4
8587	-	inserted ref.
8601	-	inserted ref. and 418 in ch. 3
8607	-	deleted extra data.
8621	-	inserted ref.
8622	-	deleted 1023 before ref.
8623	-	inserted ref, 505 in ch. 2, 417 in ch. 3
8629	-	repaired ref.
8631	-	repaired ref.
8635	-	deleted extra data.
8657	-	inserted ref.

8658 - inserted ref.
8671 - deleted extra data.
8672 - inserted ref.
8678 - inserted ref.
8685 - inserted ref.
8692 - inserted ref. and temp.
8700 - inserted ref. and temp.
8701 - deleted extra data.
8702 - deleted extra data.
8707-8 - inserted ref.
8715-6 - reconstructed sample.
8723-4 - inserted ref.
8731 - deleted extra data.
8739 - reconstructed sample.
8746 - deleted extra data.
8751 - deleted extra data.
8752-4 - deleted sample.

RCM 7690a - 3696+ samples read, 4 word and 144 sync errors. Reference reading fluctuates 1 bit. Channel selector past channel 1 on start - inserted reference reading. After sample # 2512, sync pulse missed causing instrument to continue to run until valid sync pulse was recorded. Instrument was later repaired by re-centering channel selector so brushes would make good contact with stop segments and clock was replaced due to erratic interval timing.

Deleted extra data after sample #: 2514, 2518, 2521, 2522, 2530, 2542, 2545, 2550, 2567, 2571, 2575, 2576, 2577, 2578, 2594, 2615, 2655, 2656, 2657, 2659, 2663, 2667, 2668, 2674, 2682, 2683, 2684, 2685, 2687, 2692, 2696, 2697, 2702, 2703, 2709, 2712, 2724, 2733, 2748, 2751, 2774, 2775, 2782, 2799, 2802, 2805, 2808, 2813, 2814, 2815, 2816, 2823, 2827, 2832, 2860, 2885, 2888, 2891, 2893, 2898, 2906, 2910, 2914, 2915, 2918, 2924, 2926, 2935, 2948, 2949, 2954, 2961, 2964, 2965, 2966, 2972, 2973, 2974, 3005, 3006, 3007, 3008, 3009, 3018, 3020, 3026, 3034, 3036, 3037, 3040, 3043, 3048, 3049, 3052, 3054, 3055, 3072, 3073, 3075, 3076, 3077, 3087, 3089, 3094, 3097, 3111, 3114, 3176, 3178, 3179, 3180, 3181, 3182, 3197, 3515, 3520, 3522, 3524, 3529, 3532, 3550, 3560, 3564, 3570, 3667, 3672, 3673, 3674, 3677, 3678, 3679

3697 deleted.

RCM 7690b - 4163 samples read, 1 word and 2 sync errors. First sample error - deleted. Sample # 17 missed temperature - inserted 650.

- 225
- RCM 7693 - 9099 samples read, 0 word and 1 sync errors.
First sample contained 2 sets of data - deleted
second set.
- RCM 7695 - 8637 samples read, 1 word and 0 sync errors.
Reference reading fluctuates 1 bit on deployment.
First word error - suspect tape tension on start
up.

THIRD QUARTER

22

Handwritten notes

**Tape Translation Data Quality Evaluation
for
Washington State Department of Ecology**

August 30, 1994

After reading the data from the six (6) tapes sent for translation, a data quality evaluation was performed. Enclosed are the graph printouts of the raw data for the temperature, conductivity, direction and speed channels.

The enclosed data diskette contains 2 self-extracting compressed files. The data can be retrieved by copying the file to the directory on a hard drive you wish the data to be stored and executing the file. The 2 files are as follows:

RCM-RAW.EXE - contains raw data read from tape,
 including the altered file for RCM
 7689 (RCM7689.RAB).
RCM-ENG.EXE - contains engineering data files.

Following are descriptions of data quality:

RCM 7207 - 8776 samples read, 1 word error on start up and 0
 sync errors. Data quality good.

RCM 7228 - 8547 samples read, 3 word errors and 0 sync
 errors. 1 word error on start up, 2 word errors
 at start of sample # 4162 caused by bent tape.
 Data quality good.

RCM 7689 - 8029 samples read, 59025 word errors and 21
 sync errors. Almost every word marked as error
 indicating inconsistent bit pulse width. Data
 looks consistent and usable - suspect encoder cap
 geometry has changed due to age or
 vibration/impact. Similar data quality as
 previous tape translations performed on this
 instrument. Numeric errors appear beyond 7945
 samples. Error indicators removed from data and
 samples beyond # 7945 removed - file saved as
 RCM7689.RAB

RCM 7690 - 8632 samples read, 0 word errors and 1 sync
 error due to pressure word missing from sample #
 8006. Data quality good.

RCM 7693 - 8459 samples read, 0 word errors and 0 sync
 errors. Minor reference reading fluctuations of 1
 bit. Data quality good.

RCM 7695 - 6422 samples read, 0 word errors and 0 sync
 errors. Minor reference reading fluctuations of 1
 bit. Data quality good.

FOURTH QUARTER

229

**Tape Translation Data Quality Evaluation
for
Washington State Department of Ecology**

November 2, 1994

After reading the data from the six (6) tapes sent for translation, a data quality evaluation was performed. Enclosed are the graph printouts of the raw data for the temperature, conductivity, direction and speed channels.

The enclosed data diskette contains a self-extracting compressed file. The data can be retrieved by copying the file to the directory on a hard drive you wish the data to be stored and executing the file.

Following are descriptions of data quality:

- RCM 7207 - 8436 samples read, 0 word errors and 0 sync errors. Data quality good.
- RCM 7228 - 8654 samples read, 0 word errors and 0 sync errors. Data quality good.
- RCM 7689 - 7361 samples read, 59025 word errors and 3 sync errors. Almost every word marked as error indicating inconsistent bit pulse width. Data looks consistent and usable - suspect encoder cap geometry has changed due to age or vibration/impact. Similar data quality as previous tape translations performed on this instrument. Numeric errors appear beyond 7354 samples. Data samples beyond # 7354 removed - original file saved as RCM7689.ORG
- RCM 7690 - 8639 samples read, 1 word error on start and 0 sync errors. Data quality good.
- RCM 7693 - 8823 samples read, 1 word error on start and 0 sync errors. Minor reference reading fluctuations of 1 bit. Data quality good.
- RCM 7695 - 8653 samples read, 3 word errors and 7 sync errors - occurred at end of tape due to tape damage. Minor reference reading fluctuations of 1 bit. Data quality good.

Table C2: Results of analysis of certified reference materials for metals in marine sediment (mg/kg, dry).

Material*	Acceptable				ERA #216				Certified		NIST-1646				Certified		NIST 2704			
	Quarter	Range	1	2	BC	3	4	Range	1	2	BC	3	4	Range	1	2	BC	3	4	
Aluminum		3600-8400	6897	6705	5400	5350	6240	60500-64500	19633	19500	18500	20700	-	-	-	-	-	-	-	
Arsenic		41-105	74.5	69.4	76.7	80	81.4	10.3-12.9	12.1	3.0	13.2	21.6	-	-	-	-	-	-	-	
Cadmium		55-166	449	78.5	107	107	106	0.29-0.43	0.96	1.13	0.4	0.3	-	-	-	-	-	-	-	
Chromium		95-265	193	186	178	187	192	73-79	39.8	37.2	37.5	40.4	-	-	-	-	-	-	-	
Copper		84-200	128	125	126	125	134	15-21	19.1	16.1	16.6	14.8	-	-	-	-	-	-	-	
Iron		7020-15100	9480	8055	8320	9300	9390	32500-34500	23600	19600	22600	23500	-	-	-	-	-	-	-	
Lead		55-140	88.5	84.9	87.6	81.4	90.4	26.4-30.0	21.3	16.6	21.3	20.3	-	-	-	-	-	-	-	
Mercury		-	-	-	-	-	-	0.051-0.075	-	-	0.087	-	-	1.37-1.51	1.64	1.36	1.52	1.43	-	
Manganese		206-383	267	261	263	258	272	355-395	228	208	220	224	-	-	-	-	-	-	-	
Silver		62-186	2.68	4.45	2.23	5.1	-	-	-	-	-	-	-	-	-	-	-	-	-	
Zinc		98-280	181	180	179	176	182	132-144	111	110	106	112	-	-	-	-	-	-	-	

*=All values reported as mean of duplicate analysis

ERA #216= Environmental Resource Associates, lot #216- Laboratory Control Sample

NIST-1646=Estuarine Sediment- National Institute of Standards and Technology

--Not analyzed

BC=Bottom Cores

=Outside acceptable range by more than 10%

Table C3: Result of analysis of certified reference materials for polynuclear aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCBs) in marine sediment (ug/kg, dry).

Material*	HS-6				Certified Range
	1	2	3	4	
Napthalene	3300	-	4000	3400	3000-5200
Acenaphthylene	uj	-	360	760 uj	140-240
Acenaphthene	130	-	180	760 uj	160-300
Flourene	390	-	600	470 j	350-590
Phenanthrene	2600	-	4000	3000	2400-3600
Anthracene	850	-	1300	890 uj	700-1500
Flouranthene	3000	-	4800	3400	2890-4190
Pyrene	2200	-	3200	2500	2400-3600
Benzo(a)athracene	1300	-	2000	1500	1500-2100
Chrysene	1900	-	3000	2200	1700-2300
Benzo(a)pyrene	uj	-	1800	1400	1800-2600
Benzo(b)flouranthene	2900	-	4100	3200	2400-3400
Benzo(k)flouranthene	1100	-	1700	1300	1280-1580
Benzo(g,h,i)perylene	880	-	1400	1400	1060-2500
Dibenzo(a,h)anthracene	410	-	630	270	330-650
Indeno(1,2,3-cd)pyrene	1500	-	2200	1400	1370-2530
Material*					
HS-2				Certified	
Quarter	1	2	3	4	Range
Aroclor 1254	97	-	96	160	109.3-114.3

*=All values reported as means of duplicate analysis

uj=Estimated detection limit

j=Estimated concentration

HS-6= PAH in Marine Sediment- National Research Council of Canada

HS-2= PCBs in Marine Sediment- National Research Council of Canada

=Exceeds certified range by more than 20%.

Table C4: Summary of blind field duplicate results for conventionals, metals and radiodating of settling particulate matter and bottom sediments from Elliott Bay collected October 1993 to October 1994 (mg/kg, dry).

Sample No.	8272	8273	8414	8415	8524	8525	8423	8424	8552	8559
Quarter	1	1	2	2	3	3	4	4	BS	BS
Sample Type	SPM	SPM	SPM	SPM	SPM	SPM	SPM	SPM	BS	BS
Conventional	RPD	RPD	RPD	RPD	RPD	RPD	RPD	RPD	RPD	RPD
Percent Solids	27	27	27	27	24	24	23	21	66	66
TOC (%)	8.8	8.5	7.7	5.8	8.6	8.5	8.7	8.7	6.7	7.8
Grain Size (%)										
Gravel	NA	NA	0	0	2	1	0	0	14	9
Sand	NA	NA	10	9	6	6	15	13	29	17
Silt	NA	NA	54	56	39	44	43	44	47	57
Clay	NA	NA	36	35	53	49	42	43	10	17
Metals										
Arsenic	25	27	17 j	18 j	15 j	14 j	16 j	17 j	NA	NA
Cadmium	1.5 j	1.9 j	2.4	2.7	1.8	1.6	2	2.2	NA	NA
Chromium	71	87	65	70	42 j	36 j	36	37	NA	NA
Copper	150	150	190	190	130 j	120 j	120	130	63	73
Lead	130	140	180	180	120 j	110 j	110	110	160 j	120 j
Mercury	0.25 j	0.25 j	0.45	0.41	0.31	0.32	0.25	0.18	1.2	1.1
Silver	1.4 j	1.7 j	3 j	2.3 j	3.4 j	2 j	0.88 j	1.1 j	0.5 j	0.6 j
Zinc	230	250	310	300	220 j	200 j	190	190	110	110 j
Aluminum	23000	26000	20000	20000	18000	16000	15000	15000	12000	10000
Iron	35000	36000	32000	31000	28000	25000	24000	24000	21000	20000
Manganese	1200	1200	690	690	480 j	450 j	550	570	170	156
Radiodating										
Pb-210	8.2	7.3	8.0	7.6	1.4	0.94	NA	NA	0.32	0.53
Cs-137	NA	NA	NA	NA	NA	NA	NA	NA	0.14 u	0.14 u

RPD=Relative Percent Difference=[(x-y)/((x+y)/2)*100]

j=Estimated concentration

NA= Not Analyzed

--No data

SPM= Settling particulate matter

BS= Bottom sediment

Table C4(cont.): Summary of blind field duplicate results for conventionals, metals and radiodating of settling particulate matter and bottom sediments from Elliott Bay collected October 1993 to October 1994 (mg/kg, dry).

Sample No.	8272	8273	8414	8415	8524	8525	8423	8424	8550	8558
Quarter	1	1	2	2	3	3	4	4	-	-
Sample Type	SPM	SPM	SPM	SPM	SPM	SPM	SPM	SPM	BS	BS
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Sum LPAH	-	170000	85000	67000	100000	120000	160000	200000	NA	NA
Sum HPAH	-	210000	140000	130000	110000	120000	150000	210000	NA	NA
Pentachlorophenol	-	540 j	1800 j	1300 j	8400 u	6600 u	3800 u	390 u	NA	NA
Bis(2EH)phthalate	-	5800 u	9700	8000	4600 u	6000 u	3800 u	3900 u	NA	NA
Total PCBs	-	540	NA	NA	570	500	560	450	66	76 u
RPD=Relative Percent Difference=[(x-y)/((x+y)/2)*100]										

--No data

u=Not detected at detection limit shown

j=Estimated concentration

NA= Not Analyzed

SPM= Settling particulate matter

BS= Bottom sediment

**Appendix D - Individual Chemicals in Settling Particulate Matter and Bottom
Cores, dry weight basis**

Metals in Settling Particulate Matter (Table D1)

Organics in Settling Particulate Matter (Table D2)

Metals and Organics in bottom cores (Table D3)

Table D1: Results of conventionals and metals analysis of settling particulate matter (SPM) collected between October 1993 and October 1994, Elliott Bay Waterfront Recontamination Study (mg/kg, dry weight unless otherwise noted).

Station	Quarter	Solids (%)	Grain Size (%)				TOC (%)	Total Metals									
			Sand >62um	Silt 62-4um	Clay <4um	As		Cd	Cr	Cu	Pb	Hg	Ag	Zn	Al	Fe	Mn
EB1-Surface	1	27	-	-	-	7.5	41	1.6 j	74	200	140	0.41 j	0.3 uj	390	21000	41000	1300
	2	28	10	31	59	4.8	23 j	1.5	43	130	100	0.30	0.3 uj	290	20000	34000	960
	3	16	11	33	56	8.4	14 j	1.3	24 j	100	70	0.25 j	0.3 uj	200 j	9500	22000	400 j
	4	15	27	23	50	8.6	12 j	1.1	26	88	63	0.32 j	0.3 uj	170	8600	16000	390
EB1-Bottom	1	31	-	-	-	6.3	18	1.0 j	80	110	130	0.71 j	1.1 j	200	25000	33000	1000
	2	33	8	48	44	3.4	13 j	1.1	54	120	110	0.54	0.6 j	220	21000	31000	720
	3	20	8	37	55	6.1	12 j	1.0	30 j	86 j	93 j	0.61	1 j	150 j	11000	21000	340 j
	4	23	-	-	-	6.8	15 j	1.5	47	130	130	0.74	0.6 j	200	16000	29000	520
EB2	1	25	-	-	-	18.7	17	4.5 j	66	390	130	2.4 j	2.0 j	280	17000	26000	260
	2	28	10	40	50	6.8	18 j	2.6	68	190	180	1.6	2.0 j	310	20000	32000	690
	3	24	11	37	52	9.7	16 j	2.7	42 j	150 j	160 j	4.4 j	3.7 j	260 j	15000	25000	350 j
	4	23	19	42	39	11	19 j	3.7	48	190	170	2.0	0.64 j	300	16000	27000	370
EB3	1	29	-	-	-	6.7	22	1.4 j	80	130	140	0.86 j	1.4 j	220	27000	30000	1100
	2	32	9	43	48	6.3	16 j	1.2	70	120	110	0.80	1.3 j	200	22000	28000	1000
	3	24	8	35	57	7	12 j	1.3	38 j	110 j	100 j	0.94	1.8 j	170 j	17000	24000	7800
	4	22	13	37	50	8.4	15 j	1.7	41	120	120	0.79	0.96 j	210	17000	26000	560
EB4	1	27	-	-	-	8.7	26	2.0 j	79	150	130	0.92 j	1.5 j	240	25000	35000	1200
	2	30	10	34	56	5.1	18 j	1.7	59	140	120	0.70	1.4 j	250	23000	33000	1100
	3	23	7	34	59	8.5	15 j	1.7	39 j	130 j	120 j	1.4	2.7 j	210 j	17000	27000	470 j
	4	22	14	33	53	8.7	16 j	2.1	36	120	110	0.96	0.99 j	190	15000	24000	560
EB5	1	27	8	41	51	10.7	26	2.8 j	88	190	150	1.1 j	2.5 j	280	24000	35000	620
	2	25	8	45	47	6.4	18 j	2.1	57	170	140	0.94	2.2 j	270	19000	30000	670
	3	23	7	40	53	9.5	16 j	2.7	49 j	170 j	140 j	1.3	3 j	260 j	18000	29000	390 j
	4	25	16	39	45	9.9	19 j	3.2	55	170	150	1.1	2 j	270	20000	30000	340

j= Estimated value

uj= Estimated detection limit

Table D1(cont.): Results of conventionals and metals analysis of settling particulate matter (SPM) collected between October 1993 and October 1994, Elliott Bay Waterfront Recontamination Study (mg/kg, dry weight unless otherwise noted).

Station	Quarter	Solids (%)	Grain Size (%)				TOC (%)	Total Metals									
			Sand >62µm	Silt 62-4µm	Clay <4µm	As		Cd	Cr	Cu	Pb	Hg	Ag	Zn	Al	Fe	Mn
EB6-Surface	1	26	-	-	-	22	-	2.0 j	650	140	150	0.38 j	0.5 j	280	24000	35000	300
	2	22	-	-	-	4.2	18 j	1.0	56	130	100	0.71	0.3 j	350	21000	33000	520
	3	20	6	36	58	7.3	8.6 j	1.4	25 j	85 j	63 j	1.1	0.52 j	170 j	11000	18000	130 j
	4	19	14	27	59	9.8	13 j	1.5	32	90	77	0.33	0.53 j	170	12000	18000	440
EB6-Bottom	1	28	-	-	-	6.4	23	1.4 j	98	130	120	0.93 j	1.2 j	210	22000	35000	1300
	2	27	11	41	48	4.7	14 j	1.0	50	120	100	0.66	1.1 j	200	19000	29000	790
	3	21	10	37	53	7.1	12 j	1.2	36 j	110 j	90 j	0.75	1.5 j	170 j	15000	24000	410 j
	4	23	24	36	40	7.6	11 j	1.6	39	120	100	0.63	1.5 j	180	16000	23000	370
EB7	1	29	-	-	-	7.3	23	0.98 j	83	140	150	0.86 j	2.2 j	240	24000	36000	860
	2	32	19	38	43	3.8	14 j	1.3	61	150	130	0.64	1.7 j	240	21000	31000	740
	3	23	15	38	47	7.1	12 j	1.4	40 j	110 j	110 j	0.86	2.4 j	190 j	14000	23000	360 j
	4	25	18	42	40	7.0	12 j	2.2	48	140	150	0.96	0.65 j	230	17000	26000	290
EB8	1	32	-	-	-	8.9	12	1.6 j	67	340	190	1.2 j	5.2 j	280	19000	31000	270
	2	34	12	47	41	4.5	16 j	1.3	61	190	200	1.2	3.0 j	240	20000	27000	460
	3	36	11	44	45	5.1	12 j	1.0	41 j	120 j	150 j	1.1	3.3 j	170 j	14000	22000	260 j
	4	36	23	47	30	4.5	5.2 j	1.7	40	130	200	1.4	3.1 j	220	13000	14000	330
EB9	1	35	-	-	-	4.2	15	0.65 j	100	180	98	0.66 j	1.5 j	190	22000	29000	1200
	2	33	10	46	44	3.2	10 j	0.56	51	100	94	0.63	1.2 j	170	21000	24000	860
	3	20	12	39	49	4.5	7.7 j	1.3	30 j	96 j	65 j	0.5	1.8 j	130 j	14000	19000	370 j
	4	22	10	42	48	7.7	11 j	0.95	42	120	94	0.67	1.7 j	170	20000	25000	850
Overall Mean		25	12	39	49	7.2	16 j	1.7 j	67	140 j	120 j	0.96 j	1.6 j	230 j	18000	28000	780 j

j= Estimated value

uj= Estimated detection limit

Table D2: Summary of organic compounds detected in settling particulate matter (SPM) collected between October 1993 and October 1994, Elliott Bay Waterfront Recontamination Study (ug/kg, dry unless otherwise noted).

Station Depth Quarter	EB1 Surface				EB1 Bottom				EB2 Bottom			
	1	2	3	4	1	2	3	4	1	2	3	4
Acenaphthene	2100	640	700 j	810	-	1800	1600	3000	-	5200	4200	5500
Acenaphthylene	600	270 j	210 j	540 uj	-	510	450 j	520 uj	-	1400	830	1500
Naphthalene	2800	250 j	310 j	350 j	-	550	740 j	1100	-	2400	3300	2900
Fluorene	2600	1100	880 j	1600	-	2600	2200	3000	-	9200	5700	8500
Anthracene	4100	2500	2200	4300	-	6600	4500	6700	-	20000	9300	16000
Phenanthrene	17000	6100	5600	8800	-	13000	10000	18000	-	36000	21000	33000
Sum LPAH	29000	11000 j	9900 j	16000 j	-	25000	20000 j	32000	-	74000	44000	67000
Fluoranthene	21000	8900	8100	12000	-	16000	12000	21000	-	38000	20000	34000
Benzo(a)anthracene	5600	3400	3300	4400	-	7400	5800	8400	-	15000	7200	13000
Chrysene	8400	5000	5200	7100	-	9900	8600	13000	-	20000	11000	19000
Pyrene	15000	4500	5600	7000	-	12000	8500	15000	-	25000	13000	23000
Benzo(b)fluoranthene	8000	4700	4000	6200	-	8700	6500	11000	-	16000	7800	16000
Benzo(k)fluoranthene	2700	1900	1500	2500	-	3800	2800	4800	-	6200	2800	6700
Benzo(a)pyrene	4300	2400	2400	3800	-	4900	4100	7700	-	9500	4400	9800
Dibenzo(a,h)anthracene	870	560	1100 u	700	-	1200	850 j	1500	-	1600	660	1400
Ideno(1,2,3-cd)pyrene	3100	1900	1800	2700	-	3700	2700	4800	-	5300	2300	5300
Benzo(g,h,i)perylene	2000	700	1200	2000	-	1100	2100	3800	-	2500	1500	4300
Sum HPAH	71000	34000	33000	48000	-	69000	54000 j	91000	-	140000	71000	130000
Total PAH	100000	45000 j	43000 j	64000 j	-	94000	74000 j	120000	-	210000	120000	200000
2-Methylnaphthalene	1200	310 j	320 j	420 j	-	780	860 j	1700	-	2900	3100	3200 uj
Dibenzofuran	1800	570	570 j	740	-	1300	1200	2300	-	4900	3800	4700
Carbazole	1600	380 u	1100 u	1300	-	1500	990	1500	-	3500	1600	2900
Isopiorone	140 u	380 u	590 j	540 u	-	350 u	940 u	520 u	-	600 u	180 j	270 u
Retene	140 u	410	1100 u	540 u	-	660	560 j	490 j	-	1700	1400	1700
1,4-Dichlorobenzene	140 u	380 u	1100 u	540 u	-	350 u	940 u	520 u	-	600 u	640 uj	3200
Phenol	120 j	79 j	1100 u	540 u	-	140 j	940 uj	520 uj	-	600 u	640 uj	5100
4-Methylphenol	97 j	380 u	1100 u	540 u	-	350 u	940 uj	520 uj	-	600 u	640 uj	1400 uj
Pentachlorophenol	1900	1300	1200 j	6500 uj	-	350 j	9400 uj	5200 uj	-	1600 j	6400 uj	2700 uj
4,6-Dinitro-2-methylphenol	5500 u	380 u	11000 u	5400 u	-	350 u	9400 uj	5200 uj	-	600 u	6400 uj	2700 uj
Benzyl Alcohol	81 j	380 uj	2100 u	540 u	-	13000 j	1900 u	520 uj	-	600 u	1300 u	270 u
Benzoic Acid	6800	2600 uj	6900 j	16000 uj	-	350 uj	2700 j	5200 uj	-	600 uj	2300 j	8800
Di-n-butylphthalate	200 uj	450 uj	1100 uj	540 u	-	350 u	940 u	520 u	-	600 u	640 uj	270 u
Di-n-octylphthalate	140 u	500	2100 u	2700 uj	-	350 u	4200	2600 uj	-	600 u	1300 u	1400 uj
Butylbenzylphthalate	140 u	450 uj	1100 u	2700 uj	-	350 u	940 u	2600 uj	-	600 u	680	1400 uj
Bis(2-EH)phthalate	9500 uj	11000	99000 u	2100 uj	-	2800	4600 uj	1000 uj	-	8900	6400 uj	7200 j
PCBs												
1254	260	190 u	270	170 j	-	170 u	430	580	-	-	390	420
1260	240	480	270	300 j	-	400	240	560 j	-	-	320	430
Total PCBs	500	480	540	470 j	-	400	670	1100 j	-	-	710	850

uj=Estimated detection limit

--No sample

u=Not detected at detection limit shown
j=Estimated concentration

Table D2 (cont.): Summary of organic compounds detected in settling particulate matter (SPM) collected between October 1993 and October 1994, Elliott Bay Waterfront Recontamination Study (ug/kg, dry unless otherwise noted).

Station Depth Quarter	EB3				EB4				EB5						
	Bottom	1	2	3	4	Bottom	1	2	3	4	Bottom	1	2	3	4
Acenaphthene	7400		7500	5100	7600	14000		9000	13000	22000	8900		6600	5800	4200
Acenaphthylene	1100		1100	700 j	910	1800		1500	1200	1800	2200		1800	1000	1300
Naphthalene	3600		4200	5100	6100	8000		4400	10000	21000	6800		3900	4100	2500
Fluorene	10000		11000	7400	9300	20000		14000	16000	27000	14000		11000	7300	5900
Anthracene	13000		16000	11000	11000	33000		24000	15000	26000	39000		29000	15000	15000
Phenanthrene	53000		47000	30000	34000	97000		48000	52000	81000 j	63000		43000	26000	24000
Sum LPAH	88000		87000	59000 j	69000	170000		100000	110000	180000 j	130000		95000	59000	53000
Fluoranthene	45000		43000	23000	29000	70000		40000	36000	54000	57000		42000	24000	28000
Benzo(a)anthracene	11000		11000	6800	9200	18000		14000	11000	18000	16000		14000	8700	9300
Chrysene	15000		17000	11000	14000	26000		21000	16000	26000	28000		19000	14000	15000
Pyrene	30000		27000	13000	18000	46000		24000	22000	36000	39000		27000	19000	17000
Benzo(b)Fluoranthene	13000		13000	8000	11000	19000		16000	11000	18000	18000		15000	9600	13000
Benzo(k)Fluoranthene	4900		4500	3100	4400	6700		5300	4100	7400	6900		5300	4200	5200
Benzo(a)pyrene	7500		6900	6800	7300	12000		8200	6500	11000	11000		8500	5900	8000
Dibenzo(a,h)anthracene	1300		1100	800 j	1100	1800		1600	1100	1600	1500		1400	960	1100
Ideno(1,2,3-cd)pyrene	4300		4100	2900	4200	6400		4900	3300	5800	5300		4400	3000	4200
Benzo(g,h,i)perylene	2300		2000	2200	3400	3400		1200	2500	4600	2100		1800	2100	3300
Sum HPAH	130000		130000	78000 j	100000	210000		140000	110000	180000	180000		140000	91000	100000
Total PAH	220000		220000	137000 j	170000	380000		240000	220000	360000	310000		240000	150000	150000
2-Methylnaphthalene	4000		4100	3700	4800	8200		5200	9600	17000	5800		4400	4200	2600
Dibenzofuran	6500		6800	4600	6100	1300		8800	11000	19000	8200		6600	5000	3800
Carbazole	3000		3400	2900	2000	5900		4100	2700	4500	5200		4500	1800	2000
Isophorone	130 u		450 u	820 u	440 u	210 u		580 u	750 u	390 u	140 u		890 u	290 j	320 u
Retene	130 u		920	1200	930	210 u		1100	22000	1100	140 u		1400	1400	910
1,4-Dichlorobenzene	130 u		450 u	820 u	60 j	210 u		580 u	750 u	390 u	89 j		890 u	780 u	320 u
Phenol	82 j		76 j	820 u	800 u	110 j		120 j	750 u	390 u	160		890 u	780 u	320 u
4-Methylpend	74 j		450 u	820 u	870 j	120 j		580 u	730 j	390 u	2100		890 u	780 u	340 u
Pentachlorophenol	440 j		320 j	8200 u	2900 u	540 j		340 j	7500 u	2100 u	690 u		890 u	480 j	3200 u
4,6-Dinitro-2-methylphenol	4700 u		450 u	8200 u	4400 u	8300 u		580 u	7500 u	3900 u	5600 u		890 u	8000 u	3200 u
Benzyl Alcohol	150 j		450 u	1700 u	440 u	210 u		7600 u	1500 u	390 u	140 u		4700 u	1600 u	320 u
Benzoic Acid	3500		2500 u	3700 j	6900 u	6600		580 u	5600 j	4600 u	3400		890 u	6000 j	3200 u
Di-n-butylphthalate	39000 j		450 u	820 u	980 u	510 u		580 u	750 u	950 u	8500 u		890 u	1700	410 u
Di-n-octylphthalate	120 u		450 u	1700 u	2200 u	210 u		580 u	1500 u	1900 u	140 u		890 u	1600 u	670 u
Butylbenzylphthalate	210 u		450 u	820 u	2200 u	260 u		580 u	750 u	1900 u	140 u		32000	780 u	1600 u
Bis(2EH)phthalate	3500 u		18000	16000 u	2700 u	5800 u		7000	5300 u	3900 u	8400 u		10000	9000	5700 u
PCBs															
1254	210		230 u	230	260	270		290 u	290	240	330		440 u	320	280
1260	190		360	240	360 j	270		410	250	270	230		430 j	300	270
Total PCBs	400		360	470	620 j	540		410	560	510	560		430 j	620	550

uj=Estimated detection limit

--=No sample

u=Not detected at detection limit shown

j=Estimated concentration

Table D2 (cont.): Summary of organic compounds detected in settling particulate matter (SPM) collected between October 1993 and October 1994, Elliott Bay Waterfront Recontamination Study (ug/kg, dry unless otherwise noted).

Station Depth Quarter	EB6 Surface				EB6 Bottom				EB7 Bottom			
	1	2	3	4	1	2	3	4	1	2	3	4
Acenaphthene	-	510 j	3200	5500	6000	4900	2700	3900	5900	4200	5200	3500
Acenaphthylene	-	760 j	680 j	1000 uj	1200	1100	580 j	880 uj	1500	940	810 j	1100
Naphthalene	-	300 j	1400	4700	2700	1600	1600	1900	3200	3900	3300	2200
Fluorene	-	1900	4500	6800	8700	8100	3600	5300	8100	6400	6400	4800
Anthracene	-	9000	7000	14000	19000	18000	7100	11000	17000	12000	8600	9400
Phenanthrene	-	9700	16000	26000	41000	31000	15000	22000	38000	24000	26000	21000
Sum LPAH	-	22000 j	33000 j	57000	79000	65000	31000 j	44000	74000	51000	50000 j	42000
Fluoranthene	-	20000	13000	26000	37000	29000	14000	21000	41000	27000	28000	30000
Benzo(a)anthracene	-	8000	4600	7200	10000	9400	5100	6800	13000	10000	9300	9800
Chrysene	-	16000	6500	15000	16000	14000	7600	10000	19000	14000	13000	15000
Pyrene	-	11000	7700	15000	25000	18000	9200	12000	26000	15000	17000	18000
Benzo(b)fluoranthene	-	8900	4000	10000	13000	10000	5300	8900	15000	9900	8700	11000
Benzo(k)fluoranthene	-	3000	1800	3400	4000	4200	2300	2900	5100	4400	3400	4900
Benzo(a)pyrene	-	4400	2300	5300	7000	5400	3100	5300	8600	5600	4900	6900
Dibenzo(a,h)anthracene	-	850	460 j	810	1000	920	550 j	830	1300	940	830 j	970
Ideno(1,2,3-cd)pyrene	-	2500	970	2900	3700	3000	1700	2900	4200	2900	2500	3500
Benzo(g,h,i)perylene	-	1700 j	840 j	2500	2800	1200	1100	2300	2600	820	1900	2800
Sum HPAH	-	76000 j	42000 j	88000	120000	95000	50000 j	75000	140000	91000	90000 j	100000
Total PAH	-	98000 j	75000 j	150000	200000	160000	81000 j	120000	210000	140000	140000 j	140000
2-Methylnaphthalene	-	250 j	1900	4200	3200	2300	1800	2200	3200	2300	3100	1700
Dibenzofuran	-	720 j	3000	4900	5700	5000	2500	3400	5200	1900	4300	3100
Carbazole	-	1500	950	2400	3300	2700	1100	1500	2800	4000	1400	1200
Isophorone	-	1900 u	860 u	550 u	130 u	450 u	880 u	450 u	52 j	470 u	920 u	350 u
Retene	-	510 j	860 u	360 j	130 u	800	810 j	670	120 u	820	1000	870
1,4-Dichlorobenzene	-	1900 u	860 u	550 u	130 u	450 u	880 u	450 u	120 u	470 u	920 u	350 u
Phenol	-	1900 u	860 uj	2600	100 j	110 j	880 u	650 uj	54 j	120 j	920 u	670 uj
4-Methylphenol	-	1900 u	860 u	550 uj	130 u	450 u	880 u	14000	130	470 u	920 u	4600
Pentachlorophenol	-	1900 u	8600 uj	5500 u	660 u	450 u	8800 u	4500 u	620 u	470 u	9200 uj	3500 u
4,6-Dinitro-2-methylphenol	-	1900 u	8600 uj	5500 u	5300 u	450 u	8800 u	4500 uj	5000	9500	9200 uj	3500 uj
Benzyl Alcohol	-	1900 u	1700 u	550 u	130 u	450 u	1800 u	450 u	120 u	470 u	1800 u	350 u
Benzoic Acid	-	76000 uj	3000 j	15000 uj	22000 uj	34000 uj	6700 j	4500 u	2700	2000 uj	4900 j	3100 uj
Di-n-butylphthalate	-	1900 u	860 u	1000 uj	3300 uj	450 u	880 u	800 uj	200 uj	470 u	960 uj	3600 uj
Di-n-octylphthalate	-	1900 u	1700 u	2800 uj	130 u	450 u	1800 u	2300 uj	120 u	470 u	1800 u	1800 uj
Butylbenzylphthalate	-	1900 u	860 u	2800 uj	130 u	450 u	880 u	2300 uj	210	470 u	920 u	1800 uj
Bis(2EH)phthalate	-	11000	4300 uj	3500 uj	4600	6200	3200 uj	2300 uj	4100 uj	4900	47000 uj	2200 uj
PCBs	-	-	T	160 j	210	230 u	220	250	260	-	230 j	240
1254	-	-	T	280 j	170	300	190 j	310	200	-	180 j	240
1260	-	-	-	440 j	380	300	410 j	560	460	-	410 j	480
Total PCBs	-	-	-	-	-	-	-	-	-	-	-	-

u=Not detected at detection limit shown

j=Estimated concentration

uj=Estimated detection limit

--No sample

Table D2 (cont.): Summary of organic compounds detected in settling particulate matter (SPM) collected between October 1993 and October 1994, Elliott Bay Waterfront Recontamination Study (ug/kg, dry unless otherwise noted).

Station	EB8				EB9					
Depth	Bottom	1	2	3	4	Bottom	1	2	3	4
Quarier										
Acenaphthene	900	1200	970	1200	1200	660	1300	1500	1700	1700
Acenaphthylene	560	720	360 j	460	460	210	390 j	200 j	430	430
Naphthalene	1100	1200	930	980	1400	310	620	1100	1200	1200
Fluorene	1300	2100	1100	1400	1400	120 uj	1800	1600	2200	2200
Anthracene	2700	5000	2100	2900	2900	1700	2900	1500	3000	3000
Phenanthrene	5100	9200	4700	5700	5700	4000	8100	6800	8400	8400
Sum LPAH	12000	19000	10000 j	13000	13000	6900	15000 j	13000 j	17000	17000
Fluoranthene	5000	9500	5800	6700	6700	4100	9100	8000	8000	8000
Benzo(a)anthracene	2400	3900	2400	2500	2500	1400	2800	2400	2800	2800
Chrysene	3400	5800	4100	4200	4200	2200	4600	3500	4800	4800
Pyrene	4500	6600	4800	5800	5800	2600	5900	5000	5000	5000
Benzo(b)Fluoranthene	3500	5800	3700	4200	4200	2000	3900	2600	4000	4000
Benzo(k)Fluoranthene	1400	2400	1300	1800	1800	650	1400	870	1700	1700
Benzo(a)pyrene	2100	2900	2200	2700	2700	1000	2100	1500	2500	2500
Dibenzo(a,h)anthracene	120	580	340 j	470	470	210	380 j	320 j	430	430
Ideno(1,2,3-cd)pyrene	120	1900	1300	1500	1500	620	1300	850	1500	1500
Benzo(g,h,i)perylene	120	720	940	1200	1200	380	600	750 j	1300	1300
Sum HPAH	23000	40000	27000 j	32000	32000	15000	32000 j	26000 j	32000	32000
Total PAH	35000	59000	37000 j	45000	45000	22000	47000 j	39000 j	49000	49000
2-Methylnaphthalene	630	710	590	570	570	430	730	1100	1300	1300
Dibenzofuran	880	1300	830	960	960	630	1100	1100	1500	1500
Carbazole	1000	750	350 j	430	430	340	690	810 u	450 u	450 u
Isophorone	120 u	440 u	490 u	210 u	210 u	120 u	570 u	810 u	310 j	310 j
Retene	120 u	720	790	760	760	120 u	440 j	810 u	450 u	450 u
1,4-Dichlorobenzene	120 u	440 u	490	210 u	210 u	120 u	570 u	810 u	450 u	450 u
Phenol	5100	240 j	490 uj	210 uj	210 uj	51 j	570 u	810 uj	450 uj	450 uj
4-Methylphenol	380000	440 u	920	210 uj	210 uj	520	570 u	810 uj	450 u	450 u
Pentachlorophenol	590 u	440 u	4900 u	2100 u	2100 u	560 u	570 u	8100 uj	4500 u	4500 u
4,6-Dinitro-2-methylphenol	4700 u	8800 uj	4900 u	2100 u	2100 u	4700 u	570 u	8100 uj	4500 uj	4500 uj
Benzyl Alcohol	120 u	440 u	980 u	210 u	210 u	120 u	570 u	1600 u	450 u	450 u
Benzoic Acid	3600	2500 uj	1600 j	5100 uj	5100 uj	2700	570 u	7800 j	6400 uj	6400 uj
Di-n-butylphthalate	120 u	440 u	490 uj	260 uj	260 uj	120 uj	570 u	810 u	1300 uj	1300 uj
Di-n-octylphthalate	120 uj	440 u	980 u	1100 uj	1100 uj	120 uj	1800 j	1600 u	2300 uj	2300 uj
Butylbenzylphthalate	120 u	440 u	490 u	1100 uj	1100 uj	120 uj	570 u	810 u	2300 uj	2300 uj
Bis(2EH)phthalate	2600 uj	4500	140 uj	91000 j	91000 j	46000 uj	5300	850 uj	1900 uj	1900 uj
PCBs										
1254	370	450 j	240	310	310	120	280 u	200 u	170 j	170 j
1260	370	540	240	410	410	120	300	130 j	280	280
Total PCBs	740	990 j	480	720	720	240	300	130 j	450 j	450 j

u=Not detected at detection limit shown

j=Estimated concentration

uj=Estimated detection limit

--No sample

Table D3: Summary of metals and organics analysis of bottom cores collected June 1994 for Elliott Bay Waterfront Recontamination Study.

Sample* Interval (cm)	Grain Size				Clay ($<4\mu\text{m}$)	Total Metals (mg/kg, dry)							PCBs (ug/kg, dry)				
	TOC (%)	Sand ($>62.5\mu\text{m}$)	Silt ($62.5-4\mu\text{m}$)			Cu	Pb	Ag	Hg	Zn	Al	Fe	Mn	1242	1254	1260	Total
Core #: C1 (Between Piers 54 and 55)																	
0-8	25	7.7	13	51	36	210	260 j	4.5 j	2.2	380* j	20000	31000	230	340 j	760	580	1700 j
8-16	31	-	-	-	-	280	330 j	4.7 j	2.5	420 j	23000	33000*	270	230 j	1300	750	2300 j
16-32	33	-	-	-	-	290	480 j	3.7 j	5.5	590 j	22000	29000	230	500 j	2900	1480	4500 j
32-80	39	-	-	-	-	270	580 j	4.9 j	5.1	530 j	21000	27000	220	220 j	560	480	1300 j
80-128	44	-	-	-	-	180	510 j	5.1 j	3.4	400 j	22000	29000	250	100 u	100 u	100 u	100 u
128-140	49	-	-	-	-	90	280 j	0.9 j	2.9	280 j	25000	28000	300	79 u	79 u	79 u	79 u
Core #: C2 (Between Piers 56 and 57)																	
0-11	24	7.0	10	49	41	340	430 j	4.4 j	5.3	590 j	26000	30000	260	370 j	1900	2100	4400 j
11-21	27	-	-	-	-	300	540 j	3.8 j	7.0	710 j	24000	28000	240	680 j	2500	1300	4500 j
21-42	23	-	-	-	-	690	590 j	1.4 j	9.6	1000 j	46000	34000	210	1500 j	5500	1800	8800 j
42-105	21	-	-	-	-	300	400 j	6.2 j	12	1200 j	8500	13000	76	1400 j	4300	1100	6800 j
105-168	25	-	-	-	-	360	470 j	5.2 j	16	950 j	10000	20000	100	990 j	2700	1000	4700 j
168-206	29	-	-	-	-	1100	490 j	3.8 j	11	1700 j	11000	20000	130	300 j	150	580	1000 j
Core #: C3 (North of Pier 48)																	
0-7	58	7.3	34	46	20	160	2100 j	3.3 j	1.8	340 j	19000	28000	220	100 j	560	330	990 j
7-13	63	-	-	-	-	76	250 j	1.2 j	1.1	140 j	12000	32000	210	67 u	56 j	47 j	100 j
13-26	62	-	-	-	-	68	140 j	0.53 j	1.2	110 j	11000	21000	160	71 u	71 u	71 u	71 u
26-65	65	-	-	-	-	45	290 j	0.3 u	0.82	230 j	13000	17000	140	56 u	56 u	56 u	56 u
65-117	68	-	-	-	-	24	7.4 j	0.3 u	0.054 j	34 j	12000	15000	120	44 u	44 u	44 u	44 u
117-143	68	-	-	-	-	23	6.3 j	0.3 u	0.038 j	29 j	8700	12000	110	62 u	62 u	62 u	62 u
143-172	66	-	-	-	-	24	4.8 j	0.3 u	0.036 j	34 j	9500	13000	110	58 u	58 u	58 u	58 u
172-199	65	-	-	-	-	30	4.8 j	2.9 j	0.052 j	35 j	10000	14000	120	72 u	72 u	72 u	72 u

Sample Interval = Depths corrected for core compaction